marble. The external surface, of the shell is rough, and radiated transversely and longitudinally in a most beautiful manner by curved lines of a high order; an attentive study of the mere lined surface of the shell cannot fail to be instructive even to the man of science, and worthy to be contemplated and examined by all those engaged in the works of art and taste. The marine engineer may derive instruction from the parabolic curves delineated, and traced out by the hand of nature on the Pholas shell, in assisting him in giving the best shape to the slopes of breakwaters, and harbours constructed in the deep sea, and exposed to the run or momentum of the ocean. The curved radiation or fluting on the shell cannot fail to attract the architect engaged in the works of design and taste. It ought not to be forgotten what struck Watt in examining the joints in the tail of a lobster; nor of Smeaton in looking at the form of an oak tree; nor the falling of an apple which gave the impulse to the genius of a man justly the glory of our island, and whose name stands recorded with the proudest triumphs in the loftiest branches of science that has yet adorned the efforts of human ingenuity.

William Bald.

ENCROACHMENTS OF THE SEA AND FORMATION OF SHORES.

Sir—Public attention has of late years been much engaged by the phenomena observed upon the ocean. The tidal theory, currents, storms, &c. have each been subject to the closest scrutiny, and the result has been much valuable information connected with them. The recovery of land, and the encroachment of the sea, have been for some time, and are now subjects of great interest to the scientific world; this has induced me to request the insertion of the following few lines in the columns of your valuable journal.

The northern shore of the Bristol Channel from the port of Cardiff up to Gloucester consists of a vast flat of Moor land, varying from 1 to 1½ miles in breadth; the soil is composed of a very tenacious clay mixed with shells and a large portion of decayed vegetable matter. This tract is formed totally from the deposit of the waters of the Severn and Bristol Channel. This fact is inferred from the following circumstances:—1st. The soil above described commences about a mile and a half inwards, where its section presents a depth of about a foot, under which is found the natural soil of the country, a yellowish clay intermixed with gravel; from this point it gradually deepens to high water mark, where the depth averages from 35 to 40 feet. 2nd. If a plate or any other body, having a flat surface, be exposed on the shore, between high and low water mark, for a single tide, a deposit will be found thereon varying in thickness according to the calmness of the sea during tide, as it has been observed that the deposit is much increased in stormy wheather when the sea is violently agitated. 3rd. In excavating the Bute Docks the rudder of a ship was found about 10 feet below the surface, the iron work of which was in excellent preservation. It was at first supposed that it had sunk down by its own weight, but its peculiar shape, and the closeness and tenacity of the soil, at once indicate the fallacy of such an opinion; several oak trees were also found about 30 feet below the surface, and about 100 yards above high water mark, these were of sufficient hardness to admit of their being worked up into chairs, boxes, &c.

Fig. 1.

Fig 2

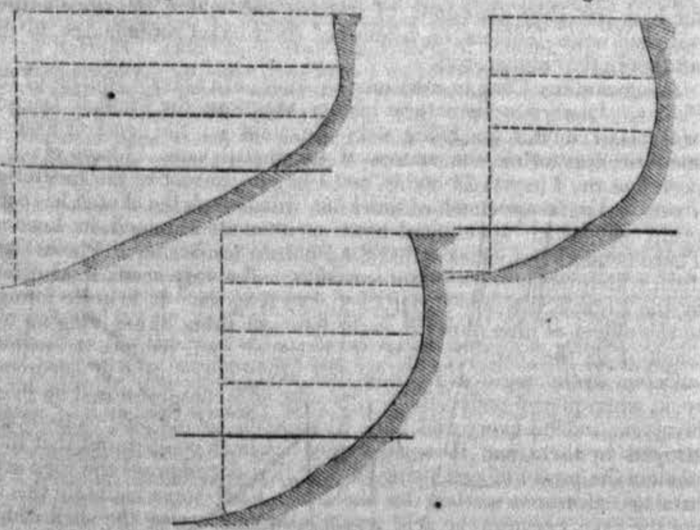

Fig. 3.

Fig. 1, the length of the upper ordinate is 6 feet, the second 6 feet 3 inches, the third 6 feet, the fourth 5 feet 1 inch, and the height of the vertical line 5 feet 9 inches. Fig 2, length of the upper ordinate 2 feet 11 inches, the second 3 feet 3 inches, the third 3 feet 2 inches, and the length of the vertical line 5 feet. Fig. 3, length of the upper ordinate is 3 feet 8 inches, the second 3 feet 9 inches, the third 4 feet, the fourth 3 feet 7 inches, and the length of the vertical line 5 feet 5 inches. The lower line is the height of high water and spring tides.

These facts, I presume, fully warrant my assertion that the shore is a deposit, and if so, it only remains to discover the cause, which appears to me to be as follows:—In many seasons when the Severn is swollen into a most impetuous and rapid torrent, vast quantities of the rich soils of Hereford, Gloucester and Worcestershire are washed down by it, and the particles prevented from sinking by the rapidity of the current, they are thus carried along until the stream is impeded in its progress by meeting the flowing tide, which runs in this channel with a velocity of from 5 to 6 miles an hour; the tide being the more powerful of the two currents, and having a set towards the South-east, pushes the other current over towards the nothern shore, where the water almost stagnates and the particles settle to the bottom. I am borne out in this opinion by the fact that there is but little current in the space between high and low water mark, a distance of about a mile, and which always sets to the westward whether the tide be ebbing or flowing.

At the high water mark the shore suddenly drops about six feet perpendicularly, the profile of the land at this part is exceedingly curious, and accompanying this paper I have sent a few sections taken at the more prominent parts, and consequently most exposed to the force of the wave. I think some very valuable hints might be taken from them in the construction of piers, sea walls, and other works exposed to the action of the sea. These sections were taken with much care, and may be fully relied on for accuracy.

I remain your most obedient servant,

NOTA.

ENCROACHMENTS AND RECESSIONS OF THE SEA.

[The following article is from the *Cinque Ports Chronicle* of February last, it is a reply to a paper which appeared in the Journal, page 64, for February last, under the signature E.]

We regret that "E," while he questions the accuracy of our theory, has not started some tangible objection for us to grapple with, and as he has not done this, we must content ourselves with a reference to some additional facts in corroboration of the view we hold of the subject. We find that as the projections of the Hastings cliffs are diminished, additional deposits of beach are formed in the West bay, gradually augmenting also at Dungeness Point, the extremity of the curve described by the sea, on account of the land, though low, consisting, we believe, of chalk or other formation, calculated to resist the action of the waves. It is also a fact that, as the Ness point augments to seaward by deposits of beach, the sea has recently made considerable encroachments to the eastward, or side opposed to the prevailing current. Within the last few days also, a temporary headland has been caused about one mile s.w. of Dover, by the fall of an immense quantity of chalk, denominated Round-down Cliff. Now by obstructing the parallel course of the western current, it would, according to our theory, throw the tide in with additional momentum upon the western pier of Dover harbour, and this, we believe, has since been realized, and so effectually as to diminish the bar of beach, which, for some months previously to this accident, had been collecting in serious and unusual quantities. Nature has thus, we conceive, by one of her accidents, demonstrated the means, which our celebrated engineers have hitherto searched for in vain, of preventing the formation of a bar of beach at the mouth of Dover harbour. Viewing that locality in connexion with our theory, we have no doubt that if masses of rock, forming a durable obstruction in the nature of a headland, were deposited at a proper distance from the entrance of the harbour, the artificial promontory would give such a curvilinear and additional impetus to the waves and current, as would tend to pass the beach beyond the east pier of the harbour.

The recent south-westerly gales have, however, contributed events under our immediate observation which, in our humble opinion, have triumphantly established the theory we have broached, and which "E" has not attacked on any specific point. The circumstances to which we allude are the following: a groyne was constructed some few months ago on the beach a little to the westward of the villas between Verulam Place and Warriors' Square, for the purpose of protecting the esplanade wall to the eastward. That it effected by retaining the beach, which effectually repels the inroads of the waves. Here, then, we had a promontory formed on a miniature scale, and it was not long before what we conceive to be the great law of nature, viz., the formation of a bay exactly proportioned to the obstruction caused to the sea by an intervening headland, became too apparent. The waters, interrupted in their course by the beach collected at the groyne, were thrown with an additional impetus to the eastward of the groyne, exactly, we believe, proportioned to the obstruction they had encountered, and after repeated assaults upon the wall, have undermined, washed it, the parade, and part of the road away, clearing out a bay, which, from measurement, we find about the perpendicular length of the groyne, which was the passive cause of the inroad. Had the groyne in question not been erected, although the wall would have been undermined and thrown down by the groyne farther west, at the South Saxon hotel, yet the inroad would have been less considerable; or had the effects of our miniature promontory been diminished, by constructing it on a smaller scale, and neutralizing its *mischievous* tendency by a well graduated line of groynes to the eastward, the inroad would have been prevented. Groynes on this part of the coast are well known to have the effect of saving and protecting land to the westward, and of endangering it unless the groynes be continued to the eastward; this any common observer would satisfactorily demonstrate to "E," and in explaining the grand alterations in the face of the coast, by reference to such miniature causes, we believe, our views are unquestionably substantiated, as far as the encroachments of the sea are concerned; and we are equally confident in the accuracy of our views with respect to the recessions of the sea, that they occur in proportion as the headlands, which, under the agency of the prevailing current, formed bays, are diminished. This would, we believe, be experimentally proved if the groyne, which has caused the injury to the esplanade wall at St. Mary Magdalen's, were reduced in length and height. The sea would throw up beach where it has recently invaded, and there it would remain to an extent exactly proportioned to the diminution of the westerly groyne or headland. Similar reductions have taken place in groynes farther to the eastward, which had been constructed on too large a scale, and their destructive tendency to the eastward thereby reduced in a direct ratio. With these facts, supporting the theory we have advanced for the general cause of the encroachments and recessions of the sea, we must, until "E" succeeds in shaking our data, instead of merely questioning them, assume that we have offered a satisfactory explanation of the interesting phenomena afforded by the alteration of the Southern coast, and, in conclusion, express a conviction that if Beachy Head and the Hastings cliffs were severally extended to the distance seaward that now exists between Pevensey castle and the sea, and also between Winchelsea,* and the present high-water mark, such an elongation of the obstructing headlands would give such an additional impetus to the sea, as to cause it again to wash the base of the hills on which those towns are situated. We have affirmed that the perpendicular line, from the ordinary high-water mark to the furthest discernible inland existence of beach, is equal to the original projection of the headlands beyond their present termini, and we believe it to be correct. We, however, invite inquiry on the subject, as also to the cause of the *regular high-water marks* successively following each other for a considerable distance on Lydd beach; the early ones being covered with green sward, evidently the produce of ages.

RESISTANCE TO RAILWAY TRAINS.

Dr. Lardner recently delivered at the Athenæum, Manchester, a course of lectures "On the resistance of railway trains, the effects of gradients, and the general economy of steam power."

Lecture I.

Dr. Lardner commenced by observing, that it was a strong example of the manner in which practical matters were conducted in this country, that they had been now ten years, with all the extraordinary effects of railways passing under their notice, stimulating their attention and calling up the wonder of all parts of Europe, and yet to this hour the general problem, the solution of which was the actual amount of resistance to railway trains, might be considered to remain, so far as the engineering profession was concerned, without solution.

It was not till a very recent period that, even on common roads, the amount of this resistance had been made the subject of inquiry. An instrument had, however, been invented by Mr. M'Neil, the engineer, who had instituted experiments to ascertain the actual resistance on turnpike roads, which he had found to be about one thirtieth part of the load. Now, the principle was equally applicable to common roads as to railways, that the resistance would be diminished in the proportion in which they enlarged the wheel; but when they increased the size, they also increased the weight, so that there was a practical limit to the diminishing of resistance in this manner. The average resistance which a load placed on a railway offered to the tractive powers was intimately connected with the principle upon which railways themselves were constructed; and this connexion had been largely acted upon by the legislature in all inquiries concerning contested railway bills. It had been assumed in parliament that an engine might be expected to pull a load, with all the necessary expedition, up an inclined plane, provided that inclined plane offered not more than double the resistance which the engine had opposed to it on a level. That had been laid down and acted upon in parliament as a species of standing order. The principle acted upon was, that the resistance upon a level would be about 9 lbs. a ton, and, consequently, an inclination which resisted 1 in 250, was an inclination up which the engine might be expected to work with a full speed. Upon this principle the sections of all the railways in the country had been laid. But the fact was, that the resistance depended upon entirely different principles. In the inquiries which took place, no one ever hinted that the resistance depended upon the speed—no one suspected for a moment that there was more resistance at thirty miles an hour than at one mile an hour. He was quite sure that many would be perfectly astonished at this statement, but it was a fact established by abundant evidence, and innumerable experiments made by philosophers at different times and in different countries, that resistance depended upon friction, and did not depend upon speed; that so far as resistance to any degree depends upon the friction of the axles upon their bearings, or the rolling motion of the tires upon the road, it was demonstrable that the resistance was the same at all speeds whatever, whether twenty, thirty, forty, or fifty miles an hour. Never supposing there was any other cause, they at once assumed that resistance, at all speeds, was either actually or nearly the same. This was the source of the error.

One of the standing orders of parliament was, that whenever a railway had a curve, with a radius of less than a mile, the committee must make a special report of such a curve, upon the supposition that it was attended with increased resistance or danger. The popular idea was, that when the wheels got to the curve, the outer flange of the wheel mounted upon the rail, by the conical form of the tire, while the other fell from off the rail; thus the one wheel acquired a diameter virtually greater than the other; that, therefore, one revolution of the outer wheel, having a virtually greater diameter, would carry it over a greater space than one revolution of the inner wheel; and that the two things would accommodate each other so that the outer wheel gets round a larger portion of the rail, while the inner wheel, being virtually smaller, gets over a smaller space, and that in this way the cone of the wheel accomplished the thing. Never was there a more consummate mechanical blunder. The fact was, the cone had nothing to do with the traversing of the carriage round a curve; and it was entirely the mechanical action of the flange pressing on the rails.

He had alluded to one or two circumstances connected with the practicable and probable speed likely to be attained on railways, and the means by which that speed might be attained. Since the great questions which had been agitated respecting the effect which an increased width of rails would have on railway transit, and the effect which very large drawing wheels, of great diameter, would have on certain railways, the question of very vastly increased speed had acquired considerable interest. Very recently, two experiments had been made, attended with most surprising results. One was the case of the Monmouth express. A despatch was carried from Twyford to London on the Great Western Railway, a distance of thirty miles, in thirty-five minutes. This distance was traversed very favourably, and being subject to less of those casual interruptions to which a longer trip would be liable it was performed at the rate of six miles in seven minutes, or six sevenths of a mile in one minute, or 360-7ths of a mile (very nearly 51½ miles) an hour. He had experimented on speed very largely on most of the railways of the country, and he had never personally witnessed that speed. The evaporating power of those engines was enormous. Another performance, which he had ascertained since he arrived in this neighbourhood, showed that great as the one was just mentioned, they must not ascribe it to any peculiar circumstance attending the large engines and wide gauge of the Great Western Railway. An express was despatched a short time since from Liverpool to Birmingham, and its speed was stated in the papers. One engine, with its tender, went from Liverpool, or rather from the top of the tunnel at Edge Hill, to Birmingham, in two hours and thirty-five minutes. But he had inquired into the circumstances of that trip, and it appeared that the time the engine was actually in motion, after deducting a variety of stoppages, was only one hour and fifty minutes in traversing ninety-seven miles. The feat on the Great Western was performed on a dead level, while, on the Grand Junction, the engine first encountered the Whiston incline, where the line rises 1 in 96 for a mile and a half; and after passing Crewe, it encountered a plane of three miles to the Madeley summit, rising 20 feet a mile, succeeded by another plane, for three miles more, rising 30 feet a mile: yet, with all these impediments, it performed the ninety-seven miles in one hour and fifty minutes, or 110 minutes; consequently the distance traversed in each minute was 97 divided by 110, or $52\frac{10}{11}$, nearly 53 miles an hour—a speed which, he confessed, if he had not evidence of it, he could scarcely have believed to be within the bounds of mechanical possibility. The engine which performed this feat had driving wheels of 5½ feet diameter; their circumference would be 17¼ feet. Taking the speed at 53 miles an hour, it was within a very minute fraction of 80 feet in a second of time. This was not the greatest speed of the engine, but the average speed spread over 97 miles, and there could be little doubt that it must have exceeded sixty miles an hour during a considerable portion of the distance. Dr. Lardner concluded by saying, "there was as yet nothing to satisfy us that a much greater speed was attainable by the adoption of the very large scale or gauge of railway which had been thought desirable by those who were interested in the Great Western Line."

Lecture II.

In this lecture the Doctor directed attention to a remarkable line of distinction which existed between inclinations upon railways of different kinds. If, for instance, they had a gradient which would fall at the rate of one foot in a thousand, the train would not roll down, because the gravitation would be insufficient to overcome the mechanical resistance. But suppose the acclivity were increased, so that the gravitation would just balance the friction, that inclination would be what in mechanics was called the angle of repose. The amount of this inclination had been made the subject of much dispute; but it had been generally assumed to be 1 in 250, or at the rate of about twenty feet in the mile. Any inclination greater than this would cause the train to move down spontaneously; and it had been assumed in railway investigations before committees of parliament, that the train, under such circumstances, would double its velocity every second of time. The inevitable conclusion to be drawn from this was, that if they had a steep inclined plane of sufficient length, the consequence would be an indefinite increase of speed till they actually acquired a velocity of 1000 miles an hour. Now, they would after this hardly credit the results which actual experiment gave. Nothing could be easier than the problem to determine the actual resistance from the motion of trains on railways, because it was a matter of easy mathematical calculation to predict what the velocity acquired at the end of the first minute would be, and, according to the rule laid down, that it would be twice as great at the end of the second minute, and so on. By comparing this with the velocity the train actually acquired, the comparison would furnish them with an easy clue. Upon this principle, Dr. Lardner had proceeded in a series of experiments made on the Whiston Plane, which has a fall of 1 in 96. They had four coaches, the gross weight of which was 15½ tons, and these coaches were propelled along the summit level to the brink of the plane, until a velocity of about 29 miles an hour was given to them, and then the engine was detached, leaving them to move down. By means of stakes placed on the side of the line, they were enabled to register the length of time it took to descend every successive 110 yards. They commenced their descent from the summit of the plane at a velocity of nearly thirty miles an hour, which, in a very short space of time, increased to 31¼ miles an hour, and then they found that gravity could do no more for them. Instead of going at the frightful velocity anticipated by parliament, they found they got into the most uniform rate of motion at the third or fourth stake, after which there was no increase of velocity whatsoever; and at this uniform motion they continued to descend till they reached the end of the plane. They submitted this experiment to all possible tests, by increasing the weight of the carriages to 18 tons, but it only gave them an increased velocity at starting of 33¾ miles, the train descending at a uniform speed the remainder of the distance.

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* Both places are said to have been washed by the sea.—Vide map, &c., "Camden's Britannia."

Upon these experiments Dr. Lardner proceeded to remark—"There is an important thing connected with this which I will briefly explain to you. The force that moves the train down an inclined plane is, as you will see, the gravitation of the weight of the train down the plane. This gravitation would, until altogether balanced by some resisting force, acquire an accelerated motion. So long as the resistance to the descending train is less than the gravitation down the plane, so long will the excess of gravitating force down the plane produce an acceleration of velocity, be it more or less. But as soon as the resistance becomes equal to the gravitating force, then there will no longer be any acceleration; the train will no longer acquire an increasing speed. On the other hand, it will not lose speed; if it did, then the inference would be, that the retarding force exceeded the gravitation; out they acquire an equilibrium, and as soon as the resisting force increases to that point that it is exactly equal to the gravitation, then the motion is uniform. The inference we deduced, therefore, was this:—that at $31\frac{8}{10}$ miles an hour, the gravitation of this train down the plane of 1 in 96 was equal to the resistance; in other words, that the resistance to that speed was $\frac{1}{96}$ part of the weight. And you will see that a necessary consequence of this is, that a train of equal weight, placed on a level, and drawn along a level at the same speed of 31¼ miles an hour, the resistance which it would oppose to the moving power would be $\frac{1}{96}$ part of the whole load. This alone will show you the extent of the error which these experiments exposed; for the common notion before was, that the resistance in all cases was $\frac{1}{250}$ part of the load, or somewhere about 9 lbs. per ton; whereas it appeared that it was in this case $\frac{1}{96}$ part of the load, or about 23 lbs. per ton; so that the engineer's estimate would be in error to the inconceivable extent of mistaking resistance of 23 lbs. for a resistance of 9lbs. per ton."

Dr. Lardner stated that he had tried similar experiments on the plane of the Grand Junction Railway, which descends from Madeley towards Crewe, at the rate of 1 in 177 for three miles; afterwards descending at the rate of 1 in 265, followed by another descent of 1 in 330. The coaches loaded at 18 tons were moved down this plane in exactly the same way, the wind being fair, and they got a velocity of 21¼ miles an hour, and with this velocity they continued to descend the three planes. On making inquiries of the engineman, he found that the steam was never cut off in descending these planes, so that, instead of accelerating the engines at a dangerous speed, as was anticipated by the parliamentary committee, they were actually insufficient to propel them at a sufficient speed for the work of the road. The result of all the experiments he made on the Madeley plane was, that he never met with an instance of propelling trains down, with a fair wind, at a speed of more than 23 miles an hour. From a comparison of the experiments made at the Madeley and Whiston planes, Dr. Lardner said, "I made a calculation, from which it appears that in the first experiment of the two trains, that portion of the resistance which is due to friction amounted to 96 lbs. only, while that which is due to the atmosphere amounted to 268 lbs. In the second experiment, with eighteen tons, the portion of resistance due to mechanical causes amounts to 100 lbs., while that which arises from the atmosphere amounts to 321 lbs., at only 33 miles an hour. One of the objections was, that the train was too light, and that no fair inference could be drawn from four carriages. We, therefore, tried trains of six and eight carriages. Several experiments were made down very steep planes—that of Whiston being 1 in 96, and that of Sutton 1 in 89. In the first experiment of six carriages, the wind was against us. Down the plane of 1 in 89, we could not get more speed than 32⅓ miles an hour. At this speed the resistance was equal to the gravitation. But with the wind favourable down the same plane, we got 37½ miles an hour, and a mean of these two would be about 35 miles an hour. On the Whiston plane, 1 in 96, with the wind adverse to us, we only got $27\frac{8}{10}$, or nearly 28 miles an hour, but with the wind favourable, we got 34 miles an hour, the mean of these being about 31. In both these cases, both on the Sutton and Whiston planes, you see the evident effects of the wind. The mean of the two, in these cases, gives, on a less steep plane, a less velocity than on a steeper plane the mean did in the other cases. It is remarkable, and very satisfactory in confirmation of the former experiment, that we had six carriages in a calm descending the Sutton plane, and what was our uniform speed? 35⅓ miles an hour, the atmosphere being calm. In two other cases down the same plane, with adverse wind, we got a speed of 32⅓ miles an hour; with favourable wind, 37⅓ miles, the mean of which is 35½ miles; so that in a calm we got a mean between the speed with a favourable and that with an adverse wind. All these harmonies in the results are so many corroborations of the principle which they develop."

Lecture III.

In this lecture the Doctor explained a variety of experiments made on railways, in order to ascertain the source of resistance. He found that an enlarged temporary frontage constructed with boards, of probably double the magnitude of the ordinary front of the train, caused an increase of resistance so trifling and insignificant as to be entirely unworthy of account in practice. Seeing that the source of resistance, so far as the air was concerned, was not to be ascribed to the form or magnitude of the front, it next occurred to him to inquire whether it might not arise from the general magnitude of the train front ends, top and all. An experiment was made to test this; a train of waggons was prepared with temporary sides and ends, so as to represent for all practical purposes, a train of carriages, which was moved from the summit of a series of inclined planes, by gravity, till it was brought to rest; it was next moved down with the high sides and ends laid flat on the platform of the waggons, and the result was very remarkable. The whole frontage of the latter, including the wheels and every thing, a complete transverse section of the wagons, measured 24 feet square, and with the sides and ends up, so as to present a cross section, it amounted to nearly 48 square feet. The uniform velocity, attained on a plane of 1 in 177, without the sides up, was nearly 23 miles an hour; whereas, with the sides up, it was only 17 miles an hour; so that, as the resistance would be in proportion to the square of the velocity, other things being the same, there would be a very considerable difference, due to that difference of velocity. Then, at the foot of the second plane, while the sides were down, an undiminished velocity remained of 19½ miles an hour, whereas, with the sides up, it was reduced to 8½ miles an hour; so that a very extensive difference was produced. They would see at once, that this was a very decisive experiment to prove that the great source of resistance was to be found in the bulk, and not the mere section or the form, whether of the front or the back of a train; but simply in the general bulk of the body carried through the air. It was very likely to arise from the successive displacements of a quantity of the atmosphere equal to the bulk of the body; or still more probably, from the fact of the extensive sides of the train; and indeed there was little doubt that the magnitude of the sides had a very material influence; for, if they consider what is going on in the body of air extending from either side of a train of coaches, they would soon see what a mechanical power must be exercised upon it. Thus, when a train is moving rapidly, the moving power had not only to pull the train on, but it had to drag a succession of columns of air, at different velocities, one outside the other, to a considerable extent outside the train; and it did more, for it overcame their friction one upon the other; for as these columns of air were at different velocities, the one would be rubbing against the other; and all this the moving power had to encounter. This would go far to explain the great magnitude of resistance found, and its entire discordance with any thing previously suspected.

Dr. Lardner next proceeded to consider the practical bearings which the experiments he had detailed would have on the construction of railways. From these experiments a two-fold fact was deducible: first, there was unquestionably a great amount of resistance, and secondly, this resistance had a material dependence on the velocity; it diminished in a very rapid proportion as the speed was diminished. If, therefore, by slackening the speed, they could relieve the engine from any considerable portion of the resistance opposed to it, they had at once a ground for throwing overboard all the objections which had been raised against sections of railways which had considerable gradients. It was asserted that the resistance was a resistance quite independent of the speed, and that its average amount was quite equal to the gravity down a plane with a fall of twenty feet a mile. Both propositions had been proved to be false. The resistance was not constant; it depended on the speed, and its average amount was equal to a great deal more than twenty feet a mile. The gradient that represented the average resistance, instead of being twenty feet a mile, was probably fifty feet; and instead of having no power of limiting the speed, they had a power to which there was scarcely a practical limit. The lecturer stated that he had been ridiculed for the opinion he had advanced before the committee of the House of Commons, that the Southampton Railway Section, of twenty feet to the mile, was as practically good as that of the Great Western, which was on a dead level. He had made that assertion on the ground that in the descent there would be as much advantage gained as disadvantage to be encountered in the ascent; and, except the inconvenience which would result from the inequality of speed, being at one time fast and at another time slow, there would be no other inconvenience or disadvantage worth mentioning. And, therefore, he did contend that it was an extremely improvident and unwise expenditure to lavish millions in cutting through elevations and filling up valleys by large embankments, and constructing tunnels and viaducts, and all the other expensive works, to obtain a dead level. Experiments had since been made which proved the conclusions he had arrived at to be substantially correct. These experiments had been made by Mr. Wood, the engineer of the Liverpool and Manchester Railway, on the Grand Junction Line. A train of twelve carriages, each weighing five tons, was attached to the *Hecla* engine, the gross load being about 82 tons. This was started from Liverpool to Birmingham, under peculiarly favourable circumstances as regarded the calmness of the day and the state of the weather, the engine being allowed to do its own work, unassisted on the various inclines; the velocity of speed throughout the whole way from Liverpool to Birmingham and back again from Birmingham to Liverpool, was, of course, accurately ascertained, and if the theory which he had endeavoured to develop was correct, they ought to find that the average speed in ascending and descending the inclinations would be nearly equal to the speed they obtained on the level parts of the line. There were several planes along the line, and taking the steepest first, viz. 1 in 177, they ascended that plane at the uniform velocity of $22\frac{1}{4}$ miles an hour, and descended it at the rate of $41\frac{1}{3}$ miles an hour, the average being as nearly as possible $31\frac{3}{4}$ in ascending and descending. The ascent and descent of the other gradients on the line gave the same, or very nearly the same, results—the average speed varying little from 31 miles an hour. There was a considerable portion of the line level, and the speed upon that portion was 31 miles, being just the same, allowing for inevitable small discrepancies, as the average speed upon the inclines up and down the line. The plain inference which Dr. Lardner drew from these experiments was this: that the trains between Liverpool and Birmingham performed their journeys in just as short a time as they would do if the line was a dead level from terminus to terminus. He, therefore, considered it unadvisable to expend money in attaining very flat sections, gradients not exceeding thirty feet a mile being, in his opinion, practically as good as a flat and dead level.

Dr. Lardner next observed that it was inexpedient to lavish money in avoiding curves of a less radius than a mile, as no danger could, he believed, attend a curve having a radius of half a mile, perhaps less. It was, likewise, apparent that it was useless to lavish capital on expedients for greatly diminishing friction; such, for instance, as the adoption of wheels of a large diameter, for it was clear that friction afforded but an insignificant part of the sources of resistance, while, by increasing the bulk of the carriage, they gave a greater frontage, and increased the resistance from other causes. Further, observed Dr. Lardner, it seemed probable that they should not with practical trains attain, in the present state of mechanical science, those extraordinary speeds which they were accustomed to hope for some time since. It was not at all likely that they should ever move at the rate of a hundred miles an hour, for the resistance due to the velocity would increase in so enormous a proportion, that it would become an opponent too formidable for any available power to overcome; still less was it likely that those speeds would ever be obtained with profit. Upon this subject Dr. Lardner remarked, "In some experience of railway travelling, I have never witnessed a speed exceeding 45 miles an hour; I did once accomplish that speed with four coaches, but only for a short distance. Mr. Woods has told me, that he has himself gone 48 miles an hour; but that was not for any considerable distance. Let it be remembered, that great speed might be attained in this way. You may get an engine with plenty of steam; you may screw the safety-valve down so as to get a surcharge of steam; you may put no load on the engine, so as to diminish the resistance; and you may run it down a gradually declining gradient till you exhaust all the steam in her boiler upon a falling gradient. Then, if all these things be done, if the rails be clean, and if a correct account be kept, then there will be no denying that great speed has been attained. But when we speak of great speeds, this experiment, the whole length of the Grand Junction Railway and back, at the average rate of 31 miles an hour through the whole distance, with twelve coaches, was a very respectable performance indeed, in the present state of locomotive power."

Lecture IV.

Dr. Lardner said there were two principles on which railways were generally constructed:—First, by departing as little as possible from the natural surface of the ground, and distributing the inclinations very generally and evenly over the whole length of the line, in which case such power was given to the engine as to make it pull up the requisite loads with requisite speed. Others, on the contrary, proceeded on the principle of concentration, and instead of distributing the inclinations over the entire length, they threw them all into one place, as in the case of the Whiston and Sutton planes on the Liverpool and Manchester Railway, and it followed, as a necessary consequence, that the engines which were adapted for working the greater part of such lines nearly on a level, could not easily draw the loads up the inclination, which must therefore be done by additional engines; but if it had been expedient to make the whole line with inclinations like those of the Whiston and Sutton planes, there would not have been the least difficulty in working it, and those planes would have been ascended with just as much speed as that part of the line was now traversed which was nearly level.

Dr. Lardner next proceeded to consider the source of the power of the engine, the manner in which it was produced, and the mode in which it was adapted to use. They should naturally suppose that an element in engine-making of such vital importance as the quantity of surface which ought to be provided to receive the action of fire, in order to produce a given quantity of evaporation, ought to be known to engineers, but they would probably be surprised to find that even the best engineers were as ignorant of it as themselves. No two of them could agree, and they differed, not only in small quantities, but even as much as 100 per cent. Another thing of importance was the magnitude of the grate. Some held, that a square foot of grate per horse power was sufficient; some allowed more, and some less; but generally speaking, three quarters of a square foot was allowed. In the application of fuel there was also considerable difference. It might be applied so as to produce considerable effect, or so as produce comparatively little effect. In this consisted what was called the art of stoking; and in no place was this worse done, in no place did it need to be better done, than on board ships. The coals should be spread lightly upon the grate; and when in a state of incandescence, the stoker should push it back, and lay on more coals. The first effect would be, that the coals first laid on would be coked. The heat would be so great that the gaseous part would be expelled. These gases would be impelled forward by the draught; and as they passed the incandescent coal, they would be consumed, and no smoke would issue from the chimney, the smoke being the unconsumed part of the fuel. As soon as the coke at the back was consumed, the stoker should push back that in the front, and introduce a further quantity of fuel. This would make a common furnace, in fact a smoke-consuming furnace, and there would be a uniform evaporation of steam. But was this the practice observed? By no means. Neither in marine boilers nor in land boilers had the stoker any idea of taking any such pains; he adopted not the most efficient way, but the way most comfortable to himself. He proceeded in this way: he let the fire in the grate be nearly out, he then put in an enormous quantity of coal; the consequence was, the very instant this was laid on, there issued an enormous quantity of smoke, which might be frequently seen issuing from the chimney of a steam-boat. That went on for some time, till at length the chimney got a little rest. This was nothing more than the effect of putting on fresh fuel; and the smoke continued till it was burned red, and it suited the stoker's pleasure and convenience to open the grate again. In some of the best conducted government vessels this was not allowed. They paid their stokers sufficient wages, and made them do their work; and on the *Medea*, for instance, there was no smoke from the chimney at all. There was nothing new in this. Mr. Watt proposed it; and in his factory at Soho, smoke was never seen issuing from the chimney. The only effectual remedy which could be devised would be to feed the furnace by self-acting grates. One had been invented in which the grate was made circular, and it revolved. The feed of coal was placed in a hopper, and the coal passed through it like a funnel. The coal was put in that part of the grate furthest from the flue. This machine was kept in motion by the engine itself, so that to a furnace of this kind there was little necessity for the attendance of men at all.—*Midland Counties Herald.*

THE FRENCH HISTORICAL COMMISSION.*

(Extracted from the Gentleman's Magazine for February, 1840.*)*

The Report on the labours of the Committee of Arts and Monuments is so extremely interesting, that, were it not too long, we should be inclined to translate the whole. The object of this Committee is not only to publish a complete survey of the monumental antiquities of France, but also to provide for the preservation of the monuments themselves. A series of printed questions is sent to every parish throughout the kingdom, in order to obtain the primary information to regulate the proceedings of the Committee in this survey. The undertaking will require many years, and much money. Those districts and monuments will be taken first in order which are of the greatest interest, or are most important in their character, or which are in the greatest danger of perishing; for the Committee has established it as a rule, that an edifice which is threatened with ruin shall always be preferred to a monument which is in a good state of preservation. At present this Committee is occupied in the publication of specimens or models of the different forms which its labours will take. These are to be, 1, the complete survey in description and delineation of the cathedral of Noyon, as a specimen of severe ecclesiastical architecture, and, 2, of that of Chartres, as being the most extensive and superb ecclesiastical edifice in France; 3, the Roman, Merovingian, and Carlovingian antiquities of Paris, as a specimen of the mode in which the great towns will be treated; 4, the description of the arrondissement of Rheims, as a model of the monumental statistics of the provinces.

"The mission of the Committee is, in fact, to search *notre France monumentale;* to catalogue, describe, and delineate all the objects of art scattered over our soil; to draw up an archæological register, so succinct that the monuments of every age and of every kind may be mentioned in it, and of such an extent that every work of art may obtain in it a place proportionate to its esthetic or historical value.

"Two orders of works are therefore to be prosecuted under the direction of the Committee: statistics for all the monuments without exception; monographies for those monuments of importance which could not be developed sufficiently in the statistics. The Committee cannot itself execute all the statistics, which will amount to eighty-six if we proceed by department, and to three hundred and fifty if we proceed by arrondissement, and give separately the statistics of several large cities, which seems desirable and necessary to produce a complete work. Neither can the Committee undertake directly all the monographies, which will amount perhaps to three hundred, which is nearly the number of the important monuments in our country which appear to merit a special work. Time and money would be wanting for such a colossal work. On the other hand, it would not do to let the designs of the Committee be regulated by chance, or to abandon them to the individual caprices of all those who might think proper to undertake an historical work on the monuments. It has therefore been thought indispensable to fix an uniform plan, and to apply it invariably to everything that shall be undertaken, without as well as with the Committee.

"Two means of attaining this result offered themselves; both have been adopted. In the first place monographies and statistics will be given as models, to which all future monographies and statistics will conform, as well in the scientific plan as in the material execution. Next, instruction will be sent to all the correspondents, and to all the antiquaries in France, to indicate the plan according to which their researches must be made, to fix the expressions which are to be used in the description of a monument, and the characteristic signs which serve to class the works of art, and to determine their age.

"As to the statistics, they will be of two kinds; those which include all the monuments of an arrondissement, and those which only comprehend the monuments of a great town.

"For the model of the statistic of an arrondissement, that of Rheims has been chosen—one of those which are most numerous in communes, and one of the richest in monuments. An architect of Rheims, M. Hippolyte Durand, has been employed to make all the drawings; the archivist and librarian of the same town, M. Louis Pâris, will write the history of the edifices; the secretary of the Committee, M. Didron, will give the description of all the monuments which will be represented by engraving and lithography.

"Paris has been chosen as the model of the statistic of a great town. This work has been entrusted to M. Albert Lenoir, who will give drawings and descriptions of all the Roman, Merovingian, and Carlovingian monuments which formerly adorned the town of Paris, and which have left numerous and imposing ruins. Paris, which possesses monuments of all epochs, from Julius Cæsar to our own days, will serve as a type for those great towns in France, Lyons, Rouen, Bordeaux, and Strasbourg.

"The Committee will give also two models of monography; for, the monuments of France being splendid or austere, it is necessary to take a severe monument and a sumptuous one.

"The cathedral of Noyon, graver still since the revolution and the course of ages have broken the statues of its portal and its painted windows, has been selected as the type of a church at once severe and original. By an exception which is rare in France, this cathedral is rounded at the extremity of its transepts, as at its apsis, and it is fronted by a porch on the west. M. Ramée has just finished the drawings of this curious monument, and M. L. Vitet, member of the Chamber of Deputies, is preparing the text.

"The Cathedral of Chartres appeared to be the monument the most complete and the richest in France—we may almost say, in Europe. Nôtre Dame de Chartres is a cathedral far more considerable than the others, by its crypt, which extends the whole length of the building; by the numerous sculptures which decorate its royal portal and its lateral porches; by its two western spires, perfect models of the architecture of the twelfth and of the fifteenth centuries; by the six *amorces* of towers which rise at the *croisillons* and at the apside; by the delicate sculptures which adorn the enclosure of the choir; by the painted glass which fills all the windows; by a great chapel—we may almost say, a little church—which the fourteenth century has attached to the great edifice of the thirteenth.

"The drawings and text of this monography appeared to be of too high a degree of importance to be entrusted to a single person. Two artists have been joined together for the graphic work: MM. Lassus, architect, and Amaury-Duval, painter. M. Lassus will make all the drawings of architecture and decoration, and will make the plans, and give the sections and elevations; M. Amaury-Duval will draw all the sculpture. The text itself, which will accompany and explain these numerous designs, will also be divided. In a literary work on a monument like Nôtre Dame de Chartres, there are two parts which are very distinct: the history of this monument, which relates its foundation, its vicissitudes, the life of the personages who have inhabited it, so to speak, that of the bishops who have adorned, enlarged, and modified it, in fact the history of its former times; and the description which tells its present state, which describes by language all its stones one after another, all the statues, all the figures painted in fresco or on glass, all the various forms which sculpture has impressed on different materials to give them a character, a style, which indicates an epoch, an age. The history of a monument, in fact, is still more different from its description, than architectural drawings are from drawings of figures; and, since there were two artists for the graphic part, it was but logical to make the same division of the literary part of the undertaking."

Besides doing all that may be possible to preserve the ancient monuments from ruin, the Committee of Arts and Monuments has taken measures to form a Museum of National Antiquities, in which the fragments of such monuments, as their endeavours have not been able to save from destruction, may be deposited.

"In spite of the zeal of the correspondents, in spite of the ardour of the Committee itself in defence of monuments threatened by men or ruined by time, many objects of art perish, many edifices fall; and, since there exists no place destined to receive the fragments, we lose even the last trace of the most interesting monuments. Since the destruction of the museum of the Petits-Augustins, our national archæology has sustained losses of this kind which are irreparable. Latterly, when the restorations were made at the church of St. Denis, when the mutilations were perpetrated on the church of St. Benoît, when the churches of St. Côme and of Cluny were demolished, they were forced to throw away among the rubbish bases and capitals of columns, sculptured tumulary stones, carved frieses and gargoyles, because the royal museums which are consecrated to pagan antiquities, cannot and will not receive national antiquities. Such a state of things could not last long without the greatest detriment to history; for no archæological studies are possible without monuments, and the monuments become rarer every day.

"Struck with these injuries inflicted upon art and historical studies, the Committee, on the proposition of Baron Taylor, begged the Minister of the Interior to grant a place for the temporary reception of the objects of art scattered in a thousand places, and which may be collected together. Afterwards, the necessity will be felt of forming a gallery of the fragments which will be gathered by little and little at a small expense, and we shall thus have a museum of Christian antiquities, which may be compared with pride to the museums of pagan antiquities. In this museum, besides the pieces which are originals, may be placed, as has been done at Louvre for the Greek and Roman monuments, plaster-casts of the finest works of art, statues, and bas reliefs which decorate our edifices of the Middle Ages. Several provincial towns already possess a Christian museum; Paris must not be behind Dijon, Orleans, Puy, Mans, or Carcassonne. The Minister of the Interior received in the most favourable manner the proposition of the Committee, and has made a formal promise to dedicate the church of St. Martin-des-Champs, now dependant on the Conservatory of Arts and Manufactures, to the reception of the fragments of Christian architecture and sculpture which may be collected at Paris and in the departments. This church, which, with St. Germain-des-Prés, is the oldest in Paris, is also the most curious for the originality of its construction and decoration; it is admirably fit for its new destination—the casket will be worthy of the precious objects which it will contain. The Minister of the Interior has promised to cause to be restored, for the object above specified, this church, which threatened to fall into ruins from the effects of age, or which was going to be demolished to make room for a *mairie*. The Committee regards this result as one of the most important it has yet obtained, and knows not how to thank sufficiently the Minister of the Interior.

"When a monument falls of itself, as has lately happened to the church of St. Sauveur at Nevers, the Committee will have but one resource, and that one it will use immediately; this will be to send an architectural draughtsman to the scene of the disaster, and to give him the task of collecting, or causing to be preserved in a museum, all the valuable fragments which may not be broken to pieces; of drawing, on the faith of traditions, on the inspection of old engravings, and the examination of the locality, a plan, sections, elevations, details; of stating, in a circumstantial report, the cause of the accident, in order to prevent the fall of monuments which may be threatened with ruin under the same circumstances. The draughtsman will return to Paris with the fragments, which will be placed in the museum,—with the drawings, which will be engraved,—with the report, which will be published. Of the ruined monument will be presented at least its portrait and some fragments. This is precisely the mission which, in the case of St. Sauveur, the Committee has entrusted to M. Robelin, architect, non-resident member of the Committee, and charged with important works in the Cathedral of Nevers, his native place."

All the evils here mentioned and provided against, are felt equally, if not more, in England; our national antiquities are daily perishing; we have no museum to receive the fragments, no public spirit in our government to provide for them, and only here and there a solitary individual who, at his own risk and inconvenience, will use his exertions to preserve, will afford a shelter to what can be saved, or will publish, or cause to be published, drawings and descriptions. We rejoice at the exertions of our neighbours, though we have reason to be ashamed at being left so far behind them. Yet we think we see at home a new spirit rising and spreading itself, and we hope that it may bear its fruit before it be too late.

We ought to add, that the Committee of Arts and Monuments is publishing manuals of the different branches of archæology, drawn up by the first scholars in each branch, and intended more particularly for the use of its correspondents, to draw their attention to the different points most necessary to be observed, to fix a standard to guide them with certainty in their researches and observations, and to give with accuracy and certainty that elementary knowledge which is necessary to enable them to work efficiently.

MESSRS. FAWCETT AND CO.'S ENGINE FACTORY, LIVERPOOL.

(From the Liverpool Standard.)

The object of the establishment is principally the construction of marine and other steam engines, mill machinery, pieces of ordnance, and other heavy articles of the foundry and the forge, which here pass from their rudest state, through the various requisite processes, until they are turned out bright and perfect from the hands of the finishers. The magnitude of the works may be estimated from the facts, that the premises stand upon an area of many hundred yards; that that space, nearly covered by lofty buildings, is found incommodiously small; and that the number of workmen employed in the various departments considerably exceeds seven hundred. The writer of this was a few days ago politely permitted to view the works, and was furnished with such information as the shortness of his visit would allow, by one of the partners, as well as by an attendant. We shall now notice the several departments under their respective heads, and shall conclude with some particulars of the fine marine engines now in a state of forwardness.

Founding and Boring of Cannon.

On entering the yard the attention of the visitor is arrested by the great number of cannons of various sizes and calibres, from swivels and half-pounders to thirty-two pounders, ranged on the ground, or peeping, in carriages, with portentous aspect, from door-ways, entrances, and corners. The large guns are of various fashions, some being cast from the plain models used in the French navy, others from those of the Dutch, and others (the handsomest to our thinking) of the more decorative form approved in England. In casting these guns (all solid), what is called "a head" is cast along with them, at the muzzle end, having the appearance of a plug or long tompion. This is cut off before the boring is commenced. At the breech, too, an additional square piece of the metal is cast on, by which the gun is turned by machinery while it is being bored, the borer being stationary in the operation. When outwardly cleaned and finished (with the exception of drilling the touch-hole and fixing the lock), the gun is placed horizontally, and secured so as to turn without vibratory motion. The machinery is then applied, and the gun turns rather slowly, advancing with an even pressure upon the large steel boring instrument, and continually discharging the metal which it cuts out. The gun has to be bored two or three times, according to its calibre, and when the operation is completed the bore is as bright and true as that of a fowling piece. The touch-hole is afterwards drilled out with great nicety, as are the holes, in raised portions of the breech, for the fixing of the flint lock, which has now in gunnery almost superceded the use of the match. Several guns are bored daily and simultaneously, to meet the demand at home and abroad, and a large "assortment" is kept constantly on hand to supply those governments and individuals who are bent on "mischief" or self-defence. Amongst the pieces of ordnance now in preparation or finished at the works are:—

26 thirty-two pounders, for a French house.
20 twenty-four pounders, another French order.
4 twelve pounders, for the same.

The Foundry.—This part of the works differs from most other foundries only in the immense weight of the castings, which, from the size of the building, and the number of blast furnaces, cranes, &c., may be turned out. Single pieces of twenty tons each might be accomplished, if required. The operation is interesting, but it is too generally known to require detail. The article to be cast is moulded (in sand) from wood, and enclosed within iron frame-work, a hole being left for the entrance of the metal. The metal (cast-iron) is thrown, in broken pieces, mixed with coals, into a large cylindrical furnace, the blast thrown into which, by machinery, with great force, makes a roaring noise, and soon brings the whole to a white heat. The metal, as it melts, sinks to the bottom. When all this is ready, a perforation is made with the point of an iron rod, through a sort of doorway at the bottom, which at that point is stopped up by fire clay. The boiling metal immediately rushes out in liquid white fire, and is received in pots with three long horizontal iron handles, two at one side, like those of a hand-barrow, and one at the other. By these it is carried by three or four men, according to its weight; and if the casting or castings be comparatively small, the metal is poured at once from this into the moulds, the pot being turned by the men holding the two handles. If, however, the casting be large, the smaller pots full of liquid metal are discharged into a cauldron of sufficient size, and this, from its great weight, is hoisted by a crane and placed over the casting, where it is discharged, in a careful manner, of its contents. The air, forced out of the sand by the metal, frequently makes a loud explosion, (as we witnessed,) and when the intense heat of the hissing iron perforates the outer portions of the same, blue and sulphureous looking flame issues from the sides in all directions. When the metal is sufficiently cooled, the frame-work is removed, and the castings taken out. Here may be cast any article, from a lath nail to a steam-engine cylinder, weighing from ten to fifteen tons.

The Working Engin[illegible] the Works.—On the east of the yard, on each side of which are the extensive buildings, is the larger engine, of thirty-six horse power, which works the greater part of the machinery used in the different rooms, in the several operations of turning, planing, drilling and otherwise "torturing" the obdurate but conquerable metal that falls under the cruel hands of the workmen. This engine is of the old-fashioned principle, with an immense wooden beam, secured with iron, and a large fly-wheel. It is, however, most effective, communicated by cog-wheels and shafts with the several rooms in which the power is applied to the lathes, &c. by drums and shafts. There are also other engines, but of considerably less power.

The Smithy.—This is one of the most extensive portions of the establishment. It comprises two large buildings thrown into one; and a great number of workmen are constantly employed. There is an avenue of anvils, and the constant hammering, the blowing of their fires, together with the dusky visages of the athletic workmen, remind one of the description of the abode of the Cyclops. Here, however, "bolts" are "forged," of which neither "Jove" nor his armourer "Vulcan" could have conceived any notion. All the iron-work for the steam engines is here made, with the exception of the very heavy paddle-shafts, which are brought in the rough from the Mersey Forge.

The Planing-machine Room.—In this room are valuable and elaborately-contrived machines for the planing or levelling of large plates, or other pieces of iron or brass, so as to give them a smooth, true, and polished surface. The article or piece to be planed is securely fixed by screw-bolts, &c., to an horizontal iron table, perforated with holes for the insertion of the bolts from beneath it in any required point, to suit the size or form of the article. This table, when put in motion, travels backwards and forwards, with its load on two iron rails, or parallel slides. Over the centre is perpendicularly fixed what is called the "planing tool," an instrument made of steel, somewhat in the form of a hook, with the point so inclined as to present itself towards the surface of the metal to be planed, as it approaches it on the table, so as, when all is adjusted, to plough or plane it in narrow streaks or shavings as it passes under it. The extremity of the tool is about half an inch to three quarters in breadth, and being of a round form at the under side, and ground or bevelled on the upper, presents a sort of point. If a plate of iron is to be planed, the operation commences on the outer edge, and each movement backwards and forwards of the table places it in such a position under the tool, that another small parallel cut is made throughout its whole length. The tool, in ordinary machines of this kind, is fixed so that it cuts only in one direction, as the plate is drawn against its edge or point, which is raised to allow of the backward motion of the plate. A new patent has, however, been obtained for a great improvement in this respect by Mr. Whitworth, of Manchester, and several of his machines are on Messrs. Fawcett and Co.'s premises. In these, by a peculiarly beautiful contrivance, the cutting instrument, the moment the plate passes under it, "jumps" up a little in the box or case to which it is attached, and instantly "turns about" in the opposite direction, and commences cutting away, so that both backwards and forwards the operation goes on without loss of time. The workmen very quaintly and appropriately call this new planing tool "Jim Crow." A workman attends to each of the machines, and when the piece to be cut is fixed with great exactness on the moving table, by a spirit level, he has nothing to do but to watch that it remain so, and that the machinery work evenly and correctly. Where a very smooth surface is required, the operation of planing is repeated, and two plates thus finished will be so truly level, that they will adhere together. It should be added, that so perfect are these machines, that in addition to planing horizontally, they may be so adjusted as to plane perpendicularly, or at any given angle.

The Turning Rooms.—In several of the rooms both hammered and cast iron of all possible dimensions are turned, with astonishing facility and correctness, on what are called slide lathes. In one of these we saw the paddle-shafts for the President under the operation. Each of these weighed, when they came from the forge, about ten tons, and they will be but slightly reduced in weight by turning. In the same room large piston and other rods were being turned. While the shaft or rod is revolved, the cutting instrument, fixed to a slide, on which it is slowly and evenly carried along, performs its operations with wonderful precision, frequently cutting a large and continuous shaving of thirty or forty feet in length (as may be,) apparently as if it were lead, and which, curling up, forms a curious and perfect worm or screw. From the great pressure of the tool, one of the edges of this screw is frequently split into regular teeth like those of a fine comb, but shorter. The tool, when it has gone from end to end of a shaft or rod, is, by a simple adjustment, made to travel back again, and the operation is continued till the whole is of the required diameter, and perfectly bright and polished. Another interesting operation in this department is the turning and polishing of circular pieces of machinery, whether dished or flat. The tops or lids of the cylinders of large engines are the principal, and some idea may be formed of the advancement of this art, by an inspection of the cylinder tops of the President, which are as bright as mirrors, and are 80 inches in diameter! Water constantly dropping on the cutting tool from a small pipe, is all the "oil" used either in planing or turning.

The Fitting-up Shops.—There are several rooms in which the "fitters-up" are employed. These finish the smaller brass and iron-work of the engines, and have turning-lathes, and all manner of hand-tools. In the building of an engine, they hold the same relation to the foundry and the forge, that the clock and watch maker (properly "finisher") does to the establishment that supplies him with his wheels and other works in the rough.

The Model or Pattern-Makers' Room.—These rooms are extensive, and many first-rate workmen are employed, the greatest exactness being required, otherwise the castings would be unavailable. The timber used is almost wholly well-seasoned deal. Many of the patterns are complicated and beautiful, a great deal of taste being displayed in the mouldings and other decorations, where such can be appropriately introduced. The models are all finished and polished in the best possible manner.

The Model Rooms.—These are a lofty part of one of the buildings, and are well worthy of a visit. In one of them we were fairly lost, amidst many hundreds of bevelled, cog, and other mill wheels, of all possible sizes, (few alike) and piled up to the very roof. Many of these are, we learned, for the purpose of supplying foreign orders. Here, too, are a variety of engine-bed plates, paddle-wheel centres, patterns for water and other wheels, &c. &c. all made with mathematical accuracy.

In another room were an immense number of models of great guns, as adopted, in outward fashion, by the English, the French, the Dutch, and others. The models of beams for marine engines, of all sizes, were here piled; also of Ionic fluted pillars for their frames. The models from which the beams, &c., of the Royal William, and many others, were cast, are here deposited, as are those of the larger engines in the yard below. The collection of patterns of all descriptions is indeed great and excellent, and must have cost an immense sum of money.

The Engines now in course of completion.—The following engines are now in hand at the works, and the three largest nearly completed:

1 pair of 540 horse power for the "President."
1 do. 420 ditto the "United States."
1 do. 450 ditto a French man-of-war steam frigate.
1 do. 300 ditto H. M. S. "Medina."
1 do. 50 ditto the "Calcutta Steam-tug."*
1 do. 45 ditto a Government tender.†
1 single engine of 60-horse power, for Australia.
1 do. 50 ditto for a French house.

The President's Engines.—These are the most remarkable for their size, and are really a stupendous piece of workmanship. They are already fixed up, and strike the visitor with astonishment. The castings, and all the workmanship are of the first description, and the architectural design of the framework, or pillars, is highly ornamental, without any sacrifice to the requisite strength. As probably the most suitable to attain this desideratum, the Gothic style has been adopted. The massy clustered pillars are surmounted by the pointed and moulded arch to correspond. The diagonal stays and their open work are in keeping; and such is the height and imposing effect of the whole, that visitors generally remarked that it strikingly resembled a handsome Gothic chapel. The beams are beautiful castings, as are the cylinders, and both of immense size and weight. The polished iron and brass work is superb, and the whole furnishes a gratifying proof of at once the enterprise and the ingenuity of the men of England. The following are some interesting statistics of this stupendous piece of machinery:

Diameter of cylinder...............	80 inches.
Stroke of engine	7 feet 6 inches.
Weight of cylinders	11 tons.
Valve-cases, from	6 to 6½ tons.
Beams (4 in number), upwards of ..	5 tons each.
Condensers, about	10 tons.
Gothic pillars, four pairs, each	11 tons, 7 cwt.
Diagonal stays, 4 in number, each....	4 tons.
Main, or paddle shaft...............	9 tons.
Two eduction pipes, each	18 cwt.
Boilers, each	30 tons.
Bed-plates, (two,) each in one casting	15 tons.

The whole engines and boilers, with the water, will weigh about 510 tons.

The hoisting-tackle used in setting up these engines is well worthy of notice. On the principals, or lower beams of the roof, which are of extraordinary strength, railways are fixed, upon which traversed scaffolds, railed round, and each carrying a powerful winch. On these scaffolds are also railways, at right angles with those on the beams, so that, by moving the scaffolds and the winches, any spot in the building may be attained directly perpendicular to the article to be hoisted, which, by other movements, can be lowered to any given site.

The Engines of the "United States."—These are precisely similar in construction to those of the President, differing only in being a little smaller. No detailed notice of them is therefore required. The cylinders are 73½ inches in diameter, and the power is the same as that of the Great Western,—namely, 420. They are erected in the same shed, or building, containing those of the President, and have been equally admired.

The "Medina's" Engines.—These are of 300-horse power, and though different in the style of the casting, are also got up in the best manner.

The whole three pairs of engines will be ready simultaneously for shipment; but, unluckily, the want of want of proper shears to hoist in the machinery and boilers, (there being but one pair at the Canning Dock, and a crane at the Trafalgar,) one or other of the vessels will have to wait her turn.

The pair of 45-horse power engines, for the Admiralty, are also in a forward state; as are most of the others before enumerated.

Such is a sketch of the works at Messrs. Fawcett and Co.'s establishment. We do not remember to have enjoyed a greater treat than in visiting it, and it was with considerable reluctance, that having other engagements, we could not prolong our stay on the premises, and examine some other departments. The whole is a world of mechanism within itself; and though it send forth huge and deadly weapons of war, it also produces maritime machinery calculated to extend civilisation, and to promote the amicable commercial intercourse, and mutual wealth and happiness, of nations scarcely known to each other but by name.

This firm have upwards of 700 workmen. The President will be the largest steam-packet in the world. Messrs. Fawcett and Co. have been applied to by the Bristol Steam Packet Company to make them engines of 600 horses' power each, but their present engagements do not permit of their accepting the order.

DESIGNS FOR LAYING OUT THE ROYAL BOTANIC GARDENS. INNER CIRCLE, REGENT'S PARK.

The Council of the Royal Botanic Society being desirous of giving every opportunity of securing the most efficient assistance in laying out their Gardens in the Inner Circle of the Regent's Park, announced some time ago their intention of giving a premium of fifty guineas for the best design submitted to them. During the last month the designs were exhibited for inspection in the rooms of the Society, in Pall Mall, where they have been visited by many persons connected with the Society, and by artists. It is probable that the rooms will remain open for a few days longer, previous to the decision of the Committee, until which time any of our readers would doubtless be able to obtain access to them.

The instructions drawn up for the guidance of candidates in some degree, limited them both as to the nature of the plans, and the kind of drawings they were recommended to send in. The instructions directed that a large portion of the ground should be devoted to a geographic arrangement of the plants in twelve separate compartments; the gardens should be provided for the special study of plants, as regards medicine, agriculture, arts and manufactures, scientific arrangements, and experiments; that proper conservatories and buildings should be provided. The plans were restricted to a scale of fifty feet to an inch, and it was stated that sections and detailed plans were not required. The number of designs sent in is above twenty, from many men of eminence and respectability, principally architects, but the exhibition as a whole does not show that talent which might be expected.

1, is merely a plan of the grounds in their present state.

2, by H. P., Spring Terrace, Wandsworth, is distinguished by two principal features, a nascent yearning for some hot water apparatus which is in futuro, and a parade of Owen Jones's Alhambra, the Alpha and Omega of the inventor's artistical knowledge, from this he has sucked the inspiration of a court in the Moorish style, and of a flight of steps decorated with *azulejos.* These our readers know are painted tiles, and unless he could resuscitate the Andalusian artists, we fear that they would be little better than the antiquated Dutch tiles, long since consigned to the chimney corner. The design, if it may be so called, is to form an endless walk in the gardens, so that you would never pass over the same path again.

3, by John Aiton, of Mr. Pearson's Nursery, Hampstead-road, is merely a gardener's arrangement of the plants.

4 and 5, by Martin Joseph Stutely, Architect, Gower-street, Bedford-square—5, is the ground plan, and 4 an isometrical perspective view. This design is an adaptation to the present state of the grounds, and consequently meagre. The buildings, mostly Italian, are poor. One excellent feature is a large conservatory on the north side, standing on a raised terrace, which commands a view over the Lake in the Park, and up the Vale towards Hampstead, bringing that fine scenery as it were into the Society's domain. A large raised seat affords a view of Primrose Hill.

6, John Bainbridge, flower gardener to Lord Wenlock, Escrick Park, near York—a botanical arrangement; the walks in a fantastic style; and an imitation of the various mountains on the face of the globe.

7, Alfred Bartholomew, architect, Warwick House, Gray's Inn. There is a want of effect in this design, but the arrangement suggested for the plants is ingenious. The ground is divided by imaginary lines into gores, each appropriated to the plants of some geographical region, and these gores again subdivided by concentric circles so as farther to distribute in each region the plants into the several classes of arts and manufactures, agriculture and science. In the centre is an angular conservatory. The explanations attached to the designs affords many useful remarks. Mr. Bartholomew suggests that the capitals of the columns of the conservatories might be taken from botanical subjects, and made in clay or artificial stone. A canal supplies water all round the garden.

8, W. Billinton, architect and civil engineer, Wakefield. This design is mainly a geographical arrangement, without much attempt at pictoral effect; it seems doubtful also whether the grouping of the buildings would be good. The book of explanation shows an intimate acquaintance with practical horticulture, and contains many good suggestions, particularly with regard to maintaining an equable temperature in the large conservatory by double domes.

9, John Burges Watson, architect, 39, Manchester-street, Manchester-square. This design is illustrated in the margin by sketches of the buildings, many of which are pleasing, the plan however is not effective except with respect to a lake, apparently imitated from a former design of Mr. Henry Laxton;* from whom he seems to have derived other ideas. The reasons

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* Now building in India.

† To run, it is said, between Dover and Calais.

* See a plan of the Royal Botanic Gardens, in the Journal, vol. 1, p. 359.

Mr. Watson gives for the position of the conservatories is good, and the efforts of a cultivated artist are visible in many parts, both of the plan and explanation, which show the results of his experience at Chiswick, where he was employed; he has not however been so successful as on former occasions, when he carried off the fifty guinea prize for laying out the gardens at Manchester.

10, **Henry Laxton**, F.L.S., and **John Thompson**, landscape gardener, late head gardener to the Duke of Northumberland. This plan is principally Mr. Laxton's, but we shall dismiss it in a few words, to come to some of his other designs. It is chiefly laid out as a large flower garden, and the compartments exhibit great ingenuity. The book of reference shows great acquaintance with the botanical part of the subject. The conservatory in the centre is circular, with arms in the form of a Greek cross.

11, **Henry Heathcote Russell**, architect and civil engineer, Springfield Lodge, Garrat, near Wandsworth. A design adapted with much ingenuity to the present state of the grounds—it has, however, the usual imperfection, want of effect. A conservatory is made to run all round the gardens, which however is impracticable, on account of the state of the grounds.

12, **Edwin E. Merral**, 35, Park Lane, Leeds. This seems to be by the eminent Hollander, 'who wrote a book of boetry as dick as dat,' the crowning idea is a central platform 200 feet diameter, 5 feet high, and surmounted with an iron railing.

13, **Henry Laxton**, F.L.S., architect and landscape gardener, Adelphi Chambers. Mr. Laxton who had a great hand in laying out the grounds at the Beulah Spa, is the surveyor of the gardens to the Royal Botanic, part of whose grounds he has laid out. He has sent in four designs, all exhibiting great attention to the subject. No. 13 has a lake on the north side, before which is an extensive lawn, most essential to a metropolitan garden, where a large concourse of people is likely to be occasionally collected. In the centre of the gardens is a spacious domed conservatory, and on the south side is the principal building for the official department with a large Italian garden, surrounded by raised terraces with extensive conservatories on each side. The whole of the gardens is surrounded by an arboretum.

14 and 15, **Charles J. Nicolay**, architect, Elm Grove Cottage, near Winborne, Dorset. The ground plan is accompanied by sections showing buildings in the classic, oriental, and Tudor styles. The conservatories are on a raised platform in the centre, and the scenery on the south front is made attractive.

16, **Wyatt Papworth**, architect, 10, Caroline-street, Bedford-square. There is considerable variety of effect and breadth in this design. The ground is formed into three divisions. The first devoted to the business part of the establishment is formed by buildings with south aspects, screened at the base by trees. The second which has rock work at one end and the museum, &c. at the other, is an ornamental garden, and has to the south, the grand front, a conservatory, flanked by trees and rock work. The third division as seen from the back of the grand conservatory is a spacious lawn with a back ground of trees and shrubs.

17, **Edward Lapidge**, Derby-street, Parliament-street. This would be a grand design for St. Petersburgh, but would not be so pleasing here as it is an entire sacrifice of the beauties of nature to architectural effect. On a raised platform in the centre is a hollow square of buildings covering the area of the Great Pyramid or of Lincoln's Inn Fields.

18, is a plan of Mr. Laxton's making the arrangement of the gardens at present, immediately available on an economical scale, the leading feature is a promenade walk, through the centre 30 feet wide; the outer boundary has a winding walk of about three quarters of a mile in length, judiciously laid out for an arboretum.

19, also by Mr. **Laxton**, is a design much resembling No. 13, but grander in its architectural and horticultural arrangements, so as to produce one mass of variegated effect in the shape of Italian, Dutch and French gardens, rosaries, fountains, statues, casinos, conservatories, terraces, &c.,—if sufficient funds could be raised for carrying out the whole of the design at once, without regard to the present form of the ground, we should prefer this design to any other.

20, G. A. **Cheffins**, architect, Lees-street, Piccadilly, Manchester, is the only one of the architectural competitors who is very much behind hand. His design is very nearly akin to that of the Dutch gentleman who composed No. 12. It must have puzzled Mr. Cheffins to produce any thing so bad.

21, R. H. **Essex**, 13, York-buildings, New-road. This is the climax of all that is rich in the ludicrous. A map of the world is laid down as the ground work, and a most farcical distribution of the necessary buildings is made. A gardener's cottage in the centre is at the sign of the North Pole, the lecture rooms are in the Atlantic ocean, (a witty gentleman, thought the Pacific better), the Great Desert of Africa serves as a nursery, the meridian of London is denoted by a sundial, and the capital cities of Europe by sundials. Really, really, Mr. Essex, you must have intended to enliven this otherwise dull exhibition.

LITERARY NOTICES.

A system of Practical Arithmetic by **Samuel Young**, is intended for the use of the working classes, from whose pursuits the examples are derived. This is certainly a more laudable effort than some of the nauseous affairs which are used in religious schools. The work seems carefully arranged.

On the Construction of the Ark, as adapted to Steam Navigation to India, is an effusion of a Mr. Radford. If our readers have any money to spare for metaphysical experiments, we recommend them to buy this work as a good example of how far hallucination can proceed.

On the supply of Water to the Metropolis.—This pamphlet gives a brief account of the extensive works that have been carried on by the Water Companies for the last five or six years, for improving the supply of the Metropolis with pure water. The author very evidently is a stickler for the existing companies, and ably advocates their cause; but he has allowed his zeal to overstep the mark of prudence. We shall, next month, make some additional remarks.

WORKING EXPENSES OF RAILWAYS.

Abstract of the different items of the working expenses on several lines of Railway now open: showing the ratio per cent. each item bears to the gross Receipts, and the amount of each per mile, for the half-year ending December 31, 1839.

	Name of Line.	Gross Expences.		Maintenance of Way.		Locomotive Power.		Carrying, Police, and Taxes.		Other Charges.	
		Per cent. on gross receipts.	Per mile.	Per cent. on gross receipts.	Per mile.	Per cent. on gross receipts.	Per mile.	Per cent. on gross receipts.	Per mile.	Per cent. on gross receipts.	Per mile.
			£		£		£		£		£
Opened the whole length	London and Birmingham	37·4	1143·6	13·1	461·	9·	277·7	13·	264·5	2·	62·8
	Grand Junction	47·4	958·9	4·5	125·	16·9	343·3	22·	443·6	4·	81·2
	Liverpool and Manchester	53·2	2503·9	4·1	194·3	19·1	898·6	23·4	1106·	5·9	277·9
	Leeds and Selby	49·3	681·4	9·2	127·7	18·7	258·8	18·4	256·6	2·7	36·0
	Greenwich	65·5	4828·	8·8	648·6	20·4	1504·1	27·7	2041·9	8·6	633 3
	Sheffield and Rotherham	46·7	565·3		*						
	Glasgow and Garnkirk	56·7			*						
Partially opened.	Great Western	48·8	1037·7	7·2	154·2	18·8	401·	16·4	349·5	6·2	132·9
	South Western	54·1	716·4	11·6	153·9	21·9	290·1	20·5	272·3		
	York and North Midland	28·1	208·3	†		12·4	91·8	11·2	83·6	4·4	32·9
	Eastern Counties	51·3	395·	†		24·	185·3	21·2	163·8	5·9	45·5
	Birmingham and Derby	74·2	322·7	16·4	88·4	25·4	110·6	32·2	145·9		
	Average	51·2		9·3		18·6		20·6		3·9	

* These items not mentioned in the published accounts.
† In hands of contractors.

Notes.—The London and Birmingham was chargeable with maintenance of way on 78 miles for six months, and on 34½ more for 15 weeks = 97¾ for 6 months. The other items are upon 112½ miles.

The Grand Junction is chargeable with maintenance of way on 82½ miles—and the mileage of that item is calculated on that distance—but as they carry their traffic to Liverpool and Manchester, on the Liverpool and Manchestar line, the other items are calculated on 82½ + 30 = 112½ miles.

The Birmingham and Derby maintain 38½ miles of line; but as they carry for 9 miles on the London and Birmingham line, the other items must be charged upon 47½ miles. This line was only opened in August, but the charges are calculated at the same rate for six months.—*Correspondent of the Railway Times.*

Iron Canal Boats in America.—The success of this class of boats in England, with the arrival of the Iron Steamboat at New Orleans from Pittsburg, (of a very light draught of water, carrying a great cargo,) has led to the opinion that iron canal boats, if used on the Erie canal, would double its capacity, and supersede the necessity of the enlargement. We trust that some of our enterprising forwarders will try the experiment. We are not fully acquainted with the cost of these kind of boats, but have been informed, that it will not exceed fifty per cent. on the cost of the best Lake boats. In Penn ylvania, with their mixed line of canals and railroads from Philadelphia to Pittsburg, they now use iron boats, divided into three parts. The iron boat is carried into Market-street, Philadelphia, on the return of the cars, at the Schuylkill canal they are hooked together, forming a complete boat, which afterwards passes the Allegany-ridge, by ten inclined planes, when they again take the canal and river, to reach Pittsburg. With this complicated system, they compete with us successfully for the early spring trade.—*American Railroad Journal.*

Destruction of Wooden Bridges in America by Ice.—The breaking up of the winter has caused a recurrence of a specie of accident which is far from being rare. We allude to the destruction of bridges by the combined force of a swollen stream and immense masses of ice. The liability to this kind of accident depends more upon the character of the stream nearer its source than at the location of the bridge itself. A river of any considerable size receiving the drainage of a large track of country, is of course apt to be speedily swollen by a sudden and heavy fall of rain or rapid thaw, and as one or the other of these circumstances are sure to accompany the breaking up of the ice, such streams must present locations badly adapted to ordinary wooden bridges. Shallow streams, from daming up the ice, are rather worse than others in this respect, yet they are the most frequently crossed by these insecure structures. Bridges of a more durable construction, if not built in the most substantial manner, are likely to suffer from the same cause, if the water way has been too much diminished. The proper substitute in such localities are *suspension bridges* of iron wire. These claim the preference of all others, whether in regard to economy of first cost, or their superior adaptation to the circumstances of the locality. Over a large portion of our country the character of the streams is altogether more favourable to this than any other species of structure. The example of the new bridge at Fair Mount will, we hope, speedily be followed in many places.—*American Railroad Journal.*

NEW INVENTIONS, IMPROVEMENTS, &c.

Improved Mode of Making Bricks.—A correspondent of the *Railway Times* describes a simple method of making bricks adopted on the Great Western Railway on Mr. James Bedborough's contract at or near Marston. It is the invention of Mr. W. B. Pritchard, Esq., Civil Engineer of this Railway, and late of the Chester and Crewe Railway, &c., is as follows:—The clay, only watered, is thrown into a common pug mill (or mortar mill); there it is ground in a similar manner to mortar; the bottom of the mill is divided into four quarters. into which are grooves cut, and under which are placed four moulds of the same kind as those in common use by hand-moulders. Two boys are at the quarters taking the moulds out and placing others in; and by a peculiar knife at the bottom of the mill, which presses the clay into the mould, eight bricks are made every time the horse goes round, which is twice a minute; and at that rate the horse can travel twenty miles in twelve hours, thus making 960 an hour, or 11,520 per day. The bricks made by this machine are much heavier and sounder, and the clay much better tempered, than by any other mode of manufacturing that I have ever witnessed; and the saving is 2*s.* 6*d.* per thousand, besides other advantages, &c.

Moses Poole, Lincoln's-inn, *improvements in apparatus applicable to steam-boilers, in order to render them more safe, March* 11.—The first improvement consists in a mode of applying to the boiler, as a species of safety valve, a metallic plate or disc, which shall burst when the steam in the boiler attains a certain degree of pressure, and thus relieve the boiler, which plate may afterwards be replaced with a fresh one, without stopping the working of the engines. To an aperture in any convenient part of the boiler is fixed a curved tube, terminating in an enlargement or cup, having a ledge running round the bottom for the safety disc to rest upon. Upon the disc is laid a ring, the edge of which is chamfered off, so as not to cut the disc, and this ring is secured down firmly by another ring, which is screwed into the upper part of the cup. The outer bend of the pipe contains water, both above and below the disc, in order to maintain it at the same temperature on each side. On any convenient part of the bent pipe, is fitted a cock, by closing which, the connection of the cup with the boiler is shut off, and another disc may then be replaced without stopping the operation of the engines. The second improvement consists in the application of a steam whistle, to give notice when the surface of the water in the boiler is below a certain point. The whistle is of the ordinary kind, and the aperture by which it communicates with the boiler is closed by a stem, at the lower part of which is a float, composed of cork, or some light wood, and covered with copper. When the water gets oo low, the float and stem descend with it, and the aperture being thus untopped, the steam rushes out through the whistle, and gives notice of the eficiency.—*Inventor's Advocate.* [Many years since a plan was adopted f having a disc or plate of copper or other metal attached to some part of a boiler, which was made weaker than the boiler, so that if there should be too great a pressure on the boiler, this disc would rend asunder and permit the escape of the steam, and, in some cases, allow the water within the boiler to flow on to the fire and extinguish it. With regard to the second improvement—a steam whistle has been adopted some time past in this country, and a plan very similar to the one described above, was adoptedby Messrs. Maudslays and Field, for the engines, at the water works at Brentford.—See Journal, vol. I., page 375. Ed. C. E. and A. Journal.]

Electro-magnetic Engines.—A new galvanic battery, called the mechanico-chemical battery, has lately been invented by Mr. A Smee, of the Bank of England, which promises to supersede the other forms now in use. Its principle is simple. as its power depends entirely upon finely divided platinum, deposited by means of a simple galvanic arrangement upon any other metal which is unacted upon by dilute sulphuric acid, the only fluid used. At present he finds that silver or plated copper answers admirably for the reception of the platinum, but iron, when platinized, has the same power for a time as these metals, though the iron becomes gradually dissolved. He also finds that with his battery porous tubes can, in most cases, be dispensed with, and that the battery can be advantageously made in any of the various forms hitherto employed. Its effects are more powerful than those of the sulphate of copper batteries, and in action it is less expensive. The practical application of galvanic batteries, except as an instrument of research in the laboratory of the student, is principally confined to the explosion of powder under water, or in other mining operations, for which purposes it appears useful, from its being small in compass, and requiring scarce any manipulation. Whether it may ever be used for locomotive purposes, still remains doubtful, but who knows whether in future ages electro-magnetic engines may not take the place of steam-engines.—*Atlas.*

On a simple mode of obtaining, from a common Argand Lamp, a greatly increased quantity of Light, by Sir J. F. Herschel.—The following simple, easy, and unexpensive mode of greatly increasing the quantity of light yielded by a common Argand burner, has been used by me for some years, and is adapted to the lamp by which I write, to my greatly-increased comfort. It consists in merely elevating the glass chimney so much above the usual level at which it stands in the burners in ordinary use, that its *lower* edge shall clear the *upper* edge of the circular wick by a space equal to about the fourth part of the exterior diameter of the wick itself. This may be done to any lamp of the kind, at a cost of about sixpence, by merely adapting to the frame which supports the chimney four pretty stiff steel wires, but in such a manner as to form four long upright hooks, in which the lower end of the chimney rests; or, still better, if the lamp be so originally constructed as to sustain the chimney at the required elevation without much addition, by thin laminæ of brass or iron, having their planes directed to the axis of the wick. The proper elevation is best determined by trial; and as the limits within which it is confined are very narrow, it would be best secured by a screw motion applied to the socket on which the laminæ above mentioned are fixed, by which they and the chimney may be elevated or depressed at pleasure, without at the same time raising or lowering the wick. Approximately it may be done in an instant, and the experiment is not a little striking and instructive. Take a common Argand lamp, and alternately raise and depress the chimney vertically from the level where it usually rests, to about as far above the wick, with a moderately quick but steady motion. It will be immediately perceived that a vast difference in the amount of light subsists in the different positions of the chimney, but that a very marked and sudden *maximum* occurs at or near the elevation designated in the commencement; so marked, indeed, as almost to have the effect of a flash if the motion be quick, or a sudden blaze as if the wick-screw had been raised a turn. The flame contracts somewhat in diameter, lengthens, ceases to give off smoke, and attains a dazzling intensity. With this great increase of light, there is certainly not a corresponding increased consumption of oil: at least the servant who trims my lamp reports that a lamp so fitted consumes very little, if any, more oil than one exactly similar on the common plan.—*Phil. Mag.*

Steam Boilers.—At the last sitting of the Society for the Encouragement of National Industry, and on the report of M. Séguier the younger, a gold medal was decreed to the elder M. Chaussenot, for an apparatus to render the explosion of steam-boilers impossible. According to the report, his invention is perfect, both as regards its improvements on the safety-valve, and an ingenious contrivance to give notice to the crew and passengers of impending danger. Even the contingency of wilful mischief is provided against; as in the event of all the warnings of his machinery failing, or being disregarded, the steam flows back upon the furnace, extinguishes the fire, and destroys all possibility of an explosion.

Turning Lathes.—At an ordinary meeting of the Society of Arts, the large silver medal was awarded to Mr. J. Hick, jun., of Bolton, for an improved expanding mandrel for turning-lathes. It is necessary that a mandrel should fit so accurately, as to bite on the inner surface with a force sufficient to counteract that of the tool, and, in the ordinary mode, the same mandrel cannot be used for two pieces which are of different diameters. Consequently, in many engineering establishments, a stock of mandrels is kept, amounting to 600 or 700. Mr. Hick purposes to do the same work with eight sizes of the mandril, from one inch and a quarter to ten inches. He effects his object by having the spindle of the mandril shaped on the frustrum of a cone, on the face of which are four dove-tail grooves to receive wedges, the under faces of which have the reverse inclination of the cone, so that the lines of their outside faces are always parallel with the axis of the mandrel. A nut is screwed on the spindle, which acts on the wedges through the medium of a conical cup, which drives them up to their bearings inside of the work.

The Retarder.—Full trial has now been made of this valuable invention of R. W. Jearrad, Jun., Esq., for retarding (not locking) the wheels of carriages when going down hill. Mr. Dangerfield, coach proprietor, having had it applied first to one of his Southampton coaches, and afterwards to the Shrewsbury coach, and in both cases with the greatest success. The principle of the invention is pressure so applied to the nave of the wheel as to retard its motion, or at the will of the coachman stop it altogether. The advantages of the invention are, that the power may be applied at the discretion of the coachman, so that he might take his coach down a steep hill, without allowing his horses to be pressed upon at all. This invention reflects great credit upon Mr. Jearrad, and we hope it will be extensively applied to our four wheeled carriages, for it will contribute materially to the safety of the public.—*Cheltenham Journal.*

Porcelain Letters.—A patent has lately been taken out for an invention to supersede the ordinary wooden letters usually fixed upon the facia of shop-windows. The new letters are made of porcelain, of every form and hue, and when fixed up, present a beautiful and attractive appearance. The facility of cleansing them is not the least of their qualifications; for with a sponge they are immediately brought to their pristine beauty and elegance. It is stated that they will not exceed the old wooden letters in price. Some of the patterns are very elegant, particularly the golden ones, and, being glazed, present a dazzling and animated appearance. They are not quite ready for public use, but it is expected they will soon arrive from the manufactory in Staffordshire.

New Fuel.—The Rev. Mr. Cobbold has invented a fuel composed of peat and the common refuse of gas tar, which burns with a bright flame, little or no smoke, and gives out an intense heat. It has no smell whatever, and has been tried in a grate, in comparison with coal. According to this experiment, which was made by a chemist, but without weighing the fuel, two quarts of water were evaporated in 35 minutes, leaving a good fire afterwards; while with Newcastle coal it took 51 minutes, leaving a low, burnt-out fire. Mr. Cobbold says he can render this fuel at 7*s.* per ton.—*Railway Magazine.*

A New and Effectual Method to Kyanise Timber.—Within the last two or three weeks the Manchester and Birmingham Railway Company have commenced Kyanising their wood sleepers in a much more quick and effectual manner than by the old mode of simply depositing the timber immersed in the prepared liquid. The company have had made a large iron cylindrical vessel, weighing about ten tons, and which is about thirty feet long, and six or seven feet diameter, made from wrought-iron plates, five-eighths thick, and double rivetted, which vessel is capable of resisting a pressure of 250 lbs. on the inch. The vessel being filled as compactly as possible with wood sleepers, twelve inches broad and seven inches thick, the liquid is then forced in with one of Bramah's hydraulic pumps, and worked by six men to a pressure of 170 lbs. on the inch. By this means the timber is completely saturated throughout in about ten hours, which operation, on the old system, took some months to effect.

Extraordinary Manner of Manufacturing Cloth.—A gentleman, residing at present in London, has just obtained, we are told, a patent for making the finest cloth for gentlemen's coats, &c., without spinning, weaving, or indeed without the aid of any machinery similar to those processes, and at a cost less than one fourth the present price. The most extraordinary circumstance in this contrivance is, that air is the only power used in the manufacture of the article. The ingenious inventor places in an air-tight chamber a quantity of flocculent particles of wool, which by means of a species of winnowing-wheel are kept floating equally throughout the atmosphere contained therein; on one side of the chamber is a net work of metal of the finest manufacture, which communicates with a chamber from which the air can be abstracted by means of an exhausting syringe, commonly called an air pump, and on the communication between the chambers being opened the air rushes with extreme vehemence to supply the partial vacuum in the exhausted chamber, carrying the wholly floccula against the netting, and so interlacing the fibres, that a cloth of a beautiful fabric and close texture is instantaneously made. Several of the specimens of this cloth that have been shown to scientific gentlemen and manufacturers have excited great admiration. This cloth is a species of felt, but instead of adopting the old laborious method, the above, which is denominated the pneumatic process, is used, and produces the result as it were by magic.—*Observer.*

ON THE CONSTRUCTION OF LIME KILNS.

BY SIR C. G. STUART MENTEATH, BART.

Having been engaged in burning lime for the supply of an extensive district of country for agricultural improvements, and being distant from coal 16 miles, it was desirable to find out the best constructed kiln for burning lime with the smallest quantity of coal, and having been aware from experiment that the kilns generally employed in Great Britain for burning lime are of a construction too narrow at bottom, and too wide at top, many kilns of this construction being not more than three or four feet wide at bottom, and 18 feet wide at the height of 21 feet, were found to waste the fuel during the process of calcining the lime, or in other words, did not produce more than two measures of burnt lime shells for one measure of coal; but it is to be understood, that in whatever construction of kiln lime is burnt, the fuel required to burn limestone must vary according to the softness, or hardness, or density of the stone, and the quality or strength of the coal used. The same measure of coal in Scotland called chews, when employed, will burn a greater quantity of lime in a given time than the same quantity or weight of small coal, the chews or small pieces of coal admitting the air to circulate more freely through the kiln. Though this fact should be well known to lime-burners, yet they frequently employ small coal in burning lime, from its being procured at a less price, though really at a greater expence, as it requires a much larger quantity to produce the same effect, and a longer time to admit of equal quantities of lime being drawn out of the same kiln in a given time.

For a sale of lime for agricultural purposes in a limited district, I have found kilns of small dimensions to be most profitable; the construction of a kiln I have employed for many years was of an oval shape, five feet wide at bottom, widening gradually to six feet at the height of 18 feet, and continuing at that width to 28 feet high from the bottom. A kiln of this construction has been found to burn lime in much less time, and with a smaller proportion of fuel, than kilns of large dimensions, narrow at bottom and wide at top, as heat is well known to ascend more rapidly in a perpendicular than in a sloping direction, from which arises the superiority of a narrow kiln, with sides nearly perpendicular, compared with one with sides that slope rapidly.

Those narrow kilns will admit of being drawn out of them every day, if fully employed, more than two-thirds or nearly three-fourths of what they contain, of well burnt lime, and afford fully three of lime-shells for one measure of coal, when large circular kilns will not give out more than one half of their contents every day, and require nearly one of coal for every two measures of lime burnt. In a country sale of lime, the quantity sold every day is liable to great fluctuations; two or three cart loads will sometimes only be required from an establishment which, the day before, supplied forty; and as lime is known to be a commodity, when exposed to the action of air, which becomes more bulky and heavy, and in that state does not admit of being carried to a distance without additional labour, it has been an object of importance with me to find out a construction of a kiln which will allow of lime being kept for several days without slacking, and at the same time to prevent the fire escaping at the top of the kiln, if the kiln stands 24 hours without being employed, especially during the autumn and winter when the air is cold and the nights long. I now employ kilns of an egg shape, and also oval; the oval-shaped kilns are divided by arches across the kiln, descending four feet from the top: the object of the arches across the kiln is to prevent the sides of the kiln falling in or contracting, and also to enable you to form circular openings for feeding in the stone and coal at the mouth of the kiln; upon this plan, a kiln of any length might be constructed with numerous round mouths. From the great expense attending the driving of fuel from a distance of 25 miles from my own coal-pits, I have adopted the practice of cokeing the coal, which is a saving of two-fifths of the weight, and I find that an equal measure of coal and coke have the same quantity of heat in burning lime, which is somewhat paradoxical, but not the less true. The coal is found to have little effect upon the stone till it is deprived of its bitumen, or is coked in the kiln; for, during the time the smoke is emitted from the top of a lime kiln, little or no heat is evolved; or, in other words, does not the smoke carry off the heat, which is not given out from the smoke till it is inflamed, which does not take place in the ordinary lime kilns? A kiln in which coke is the fuel employed will yield nearly a third more lime shells in a given time than when coal is the fuel, so that coke may be used occasionally when a greater quantity of lime is required in a certain time than usual, as it is well known to lime burners that the process of burning is done most economically when the kiln is in full action, so as almost constantly to have a column of fire from the bottom to the top of the kiln, with as short intervals as possible in working the kiln.

Having found that limestone is apt to be vitrified during the process of calcination during stormy weather, from the increased circulation of air through the kiln, which adds much to the heat derived from the fuel employed, and which experienced lime-burners would have diminished could they be aware at all times of an occurrence of this kind: from having experience of the bad effects of too great a circulation without properly providing against it, I have reason to believe that by having a power to throw in at pleasure an additional quantity of air into the bottom of a lime kiln, a considerable saving of fuel necessary for the calcination of lime would take place, and another object would be gained, that of cooling the limestone in the bottom of the kiln, which frequently retards the drawing out of the burnt limestone for some hours, or until the limestone is so cold as not to burn the wooden structure of carts.

In working a kiln with narrow circular mouths, the stone and coal should be carefully measured, so that the workmen can proportion the fuel employed to the quantity of stones, and it is obvious, that the quantity of coal to be used must depend upon its relative quality, and the hardness of the stone to be burnt. If this measure was adopted in kilns of any construction, the lime shells would be found better burnt.—*The Dublin Advertiser.*

STEAM NAVIGATION.

The President Steam Ship.—This vessel, the largest ever yet built, arrived here a few days ago under the command of Captain Kean, and is now lying in Sloyne. She is an exceedingly beautiful model; built of the best material that England and England's wealth can supply, and is in every respect a noble vessel. She is now, (her engines not being yet on board,) what is in nautical term, called "light"; and loomes very large. Her proportions are, however, such but for the comparative size of the Queen's mail ships near her, she is so compact that she does not appear at even a short distance to be larger than the "Liverpool." A nearer approach, however, undeceives the beholder, and a visit on board, realizes to its fullest extent the conception of "a wooden world."

She is painted in man-of-war style, with gun ports, and is handsomely rigged as a three-masted schooner, with a foremast, foretopmast, and topgallantmast, approximating to those of a ship. Her bow is fine, and at the extremity of her headrails will be placed, when completed as a figure-head, a bust of Washington, the hero of American independence. Her stern is projective, beautifully formed to turn off a heavy sea; ornamented aloft with the arms of England, and America, quartered in heraldic shield, supported by "the Lion of England," and "Eagle of America." The paddle boxes are comparatively very slightly raised above her bulwarks; and her general appearance is, when her side is viewed, that of a first class frigate of extraordinary size, her light rigging given her at the same time a most rakish and mischievous appearance.

The following are the dimensions:—

	Feet.	In.
Length over all, from taffrail to figure-head......	273	0
Beam within the paddle-boxes	41	0
Breadth from outside of paddle boxes............	72	4
Depth of hold	30	0
Height between the main and spar deck	8	6
Height between lower and main deck (both flush)	7	8

Tonnage supposed 2500.

Those who are versed in maritime affairs will readily conceive from these dimensions that we are warranted in stating that the President, is in reality, "a wooden world." She is indeed, more—she is a world not only of wood, but of iron, copper, and other materials, constituting the *ne plus ultra* of strength in naval architecture.

The President was built at Limehouse, London, by Messrs. Curling and Carter, the latter gentleman superintending her construction throughout. Between decks and in her holds she presents a perfect picture of strength; and we cannot more highly compliment our metropolitan friends and contemporaries in Translantic Steam Navigation, than by stating that they seem in materials, in fastenings, and in putting together, to have taken a leaf out of the book of our townsmen Messrs. Wilson and Co., whose vessels both in point of strength and sailing have hitherto borne the bell.

Every available modern improvement has been taken advantage of in the construction of the President. In addition to a remarkably strong frame, solid to the bilge, she is diagonally fastened fore and aft with iron and wood, in a manner that would seem to defy the rudest assaults of the ocean wave. We have not time to enter into details. Suffice it to say, that the materials of the *President* throughout are of the best quality, and that the utmost science, in a scientific age, has been exerted to work them to the best advantage.

The engines for this vessel will be of about 600 horse power. They are already built by our townsmen Messrs. Fawcett and Co., and present a splendid specimen of the ingenuity and enterprise of the age.

The *President* will present peculiar advantages for passengers. Her spar-deck will afford a long and delightful promenade in fine weather, and during rain or storms a dry and sheltered walk may be enjoyed below.

The cabins are not yet fitted up. The principal or stern saloon will be eighty-seven feet in length; its breadth (including the small state rooms on each side) forty-one feet.

No expense has been spared to render the *President* a crack ship. In strength of materials and fidelity of workmanship, she is fully equal to any of her Majesty's ships of war; and is fitted up with all the modern improvements in pumps, tanks, &c. She is also divided into sections, so that the springing of a leak (should such take place) would be attended with comparatively trifling danger. It is calculated that the *President* will carry 1,000 tons of goods beyond her compliment of coals, luggage, and materials for a trans-Atlantic voyage. Her steering tackle is of novel and improved construction; and such was required; for, from her length and size, she may be deemed a floating island.

The agents of the *President* at this port, are Mr. Pim, of the St. George's Steam-packet Company, and Mr. Macgregor Laird, brother of Mr. Laird, of North Birkenhead, the celebrated builder of Iron ships.—*Liverpool Courier.*

The Sons of the Thames.—This vessel which we noticed in the last January number is now fairly before the public, and fully sustains the speed we then announced; she eclipses all the Gravesend steamers.

Steam-Packets to the West Indies.—The directors of the Royal Mail Steam-Packet Company have, with laudable promptitude, contracted for the building and machinery for the requisite number of steamers. Three are to be of 1250 tons burden, and are in regard to the form and the cabins, of a superior construction. They will be ready for sea in the autumn of next year, when our splendid colonies in the West Indies will be brought practically as near to us as were, not long ago, many parts of the United Kingdom to the metropolis. It would be difficult to exaggerate the beneficial effects which may flow from this change, but we shall not dilate on the subject at present. Many of our readers are aware that some controversy has arisen about the route that ought to be adopted with a view to the convenience of all the interests concerned, and it is doubtless a question which deserves full consideration. We understand the Government has the power of altering the course of the packets as circumstances may render expedient.—*Colonial Gazette.*

Steam Mail Packets.—Government having ordered a weekly mail to be conveyed by steam from Hull to Christiansand and Gottenburgh, a contract for the transit has been taken by Messrs. Wilson, Hudson, and Co., of this port, and by whom two competent steam-vessels, of the first class, will be immediately placed on the station. The service is to commence on the 2d of next month. The passage which will be imperatively undertaken at specific hours, to and from the Eastern ports, will afford a safe and certain conveyance, and thereby give an additional impetus to commercial enterprise.—*Hull Times.*

British Queen.—This noble vessel arrived at Portsmouth, on Thursday morning, 16th ult., in 14 days from New York.

The "Lee" Iron Steam Barge has been fitted with Halls patent reefing paddles, and at the beginning of last month made several trips on the Thames, off Greenwich, to show the action of reefing the paddles, both when the barge was laden and unladen. The action is very simple, in outward appearance the paddle wheel being similar to the common one,—although upon inspection it will be found very different. On the shaft of the wheel is a large iron disc about 2 ft. 6 in. radius, composed of two plates of metal; the inside face of one of them, contains a spiral groove, in which plugs are accurately fitted, and fixed to the inner end of sliding arms of iron. These arms are attached at the other or outer end to the float boards, when it is necessary to contract the size of the wheel; the disc is turned round by the aid of a winch, and as it turns round, the plugs fitted to the spiral are gradually drawn up, as the radius of the spiral groove gets smaller; and when it is requisite to enlarge the diameter, the disc is turned in the opposite direction, by this means the plugs attached to the moveable iron arm are gradually drawn into the spiral groove of a larger radius and fores out the float boards. By this simple contrivance, the wheels of the "Lee" can be contracted from a large diameter to a small diameter. For such a vessel as the "Lee" it is highly valuable, as she is to be engaged by the spirited proprietor, Mr. Lee, the extensive lime burner and brick maker, to convey lime from his works up the Medway to London, and occasionally to be employed as a tow boat for bringing up the other vessels when the wind sets directly against them, sometimes this is his case for several days, and we have known instances of London being almost without a yard of lime. We have no doubt this spirited effort of Mr. Lee will cause several iron barges to appear on the Thames before many months have passed over. The "Lee" is an iron vessel built by Messrs. Ditchburn and Mair, and furnished with two oscillating engines by Messrs. Penn and Son of Greenwich:—the various experiments proved very satisfactory.

ENGINEERING WORKS.

WESTMINSTER BRIDGE.

In a former number (23), we described briefly the construction of this interesting bridge, and the works that had been carried on for many years by the late Mr. Telford for protecting its foundations, rendered insecure by the removal of old London bridge. We also explained the extent of improvements contemplated by the commissioners, and the manner in which they were being executed by Mr. Cubitt, contractor, under the direction of Messrs. Walker and Burges.

We have now the gratification of recording the rapid progress of the works, and of congratulating the public on the immense advantages they are likely to derive from the enlightened views of the Commissioners, who in addition to the extensive improvements referred to, have decided on widening the roadway 12 feet, thus making it equal in width to London bridge. The two piers that were inclosed in the dam have been extended for that purpose, and five courses of the soffit of the arch on each side already completed. The difficulty of executing this work can be appreciated only by those who are acquainted with the construction of the foundations on caissons, and a description of the method adopted must be interesting.

By referring to the plan and section in the number alluded to, it will be seen that the intention then was to carry the sheet piling completely round the pier, at a short distance from the caisson to prevent the condensed ground disturbing the framework, afterwards to fill up this space and the openings in the grating with brick, and thus form a solid bed for the Roche Portland pavement. This was done as far as the angles of the south cutwater—the part of the caisson at that extremity was then partially removed, and bearing piles of beech, 10 feet long by 9 inches diameter, driven 3 feet apart over the space on which the extended pier and cutwater were to be erected, and the sheet piling continued round; on the bearing piles were spiked double sills of memel fir crossing over the piles, and of scantlings to bond with the caisson, and form a grating the same height, the openings were filled up with brick, and 6 in. York landings, upon which a course of Roche Portland stone was laid, extending over the whole space, and bevelled off towards the sheet piling, uniform with the pavement surrounding the pier. The Portland stone on each side of the pier was cut out to a depth of 1 ft. 6 in. and 2 feet 6 in., and courses of Bromley fall stone inserted, and carried round on the new foundations; thus the appearance of the piers and soffit of the arch, as high as the top of the fifth course from the springing, is the same as if built at one period. The north cutwaters restored by the late Mr. Telford were not disturbed.

The sluices of the dam were opened on the 13th ult. at high water, the dam having remained quite dry and secure from the time it was closed.

The work both for execution and quality of material cannot be sufficiently admired, and the piers will resist for centuries the attacks of the elements they have to contend with.

The dam round the next two piers is now partly formed, and when the water has been excluded, we promise our readers an account of the sunken pier that excited the greatest interest about 100 years ago.

Wyrley and Birmingham Canals.—About twelve months ago an arrangement was made for consolidating the Wyrley and Essington Canal Company with the Birmingham Canal Company, and we observe that on the 14th ultimo, the Act of Parliament for carrying that arrangement into effect received the royal assent. This union will not only be of great advantage to the proprietors, but also to the public, as the united company are going to lay out upwards of £120,000. in making two new lines of canal to connect the Wyrley and Essington canal with the lower level of the Birmingham canal, y one of which the mines in the neighbourhood of Wednesfield and Willenall will be brought into the market; and by the other the lower part of the town of Birmingham may be supplied with coal from the extensive and valuable mines at Brownhills and Cannock Chase. — *Wolverhampton Chronicle.*

Gloucester and Hereford Canal.—About five hundred men are now employed in the continuation of the canal from Ledbury to Hereford. Nearly the whole of the first seven miles is in progress; the works at present are confined to this portion, because the supply of water will be obtained by it, not only for the new part, but also for the sixteen miles from Ledbury to Gloucester: it is therefore anticipated that this additional supply will cause a considerable increase of revenue The most important works at present under hand are the embankment across the Leadon Valley, at Prior's Court and the deep cutting at Ashberton. The weather has lately been very favourable for the work, and the great progress already made has surprised many persons; part of the line is quite finished, and light boats constructed so as to be easily moved from place to place, are now being used on the finished portion, for the purpose of shifting soil and materials. Patent bricks for facing the locks are being made at Ledbury. The bricks are very superior to any before seen in this country. They are moulded in the usual way, and when in a particular state of dryness they are forced by a heavy weight into the metal mould, which operation not only brings the brick into a perfectly true and square shape, with a fine smooth surface, but also condenses the clay, thereby making the brick stronger and more durable.—*Hereford Times.*

Nelson Memorial.—On the 2d ult., the following tenders were presented and opened by the Nelson Testimonial Committee, held at the National Gallery, for the erection of Mr. Railton's column in Trafalgar-square; Messrs. Grissell and Peto, the builders, being the successful candidates.

Messrs. Grissell and Peto	£17,860
Messrs. Baker and Son	17,940
Mr. Jackson	18,200
Mr. Grundy	19,700
Mr. Hicks	20,500
Messrs. Malcott and Son	27,009

Skew Bridge.—Workmen are now actively engaged in the erection of one of the most, perhaps the most extraordinary iron viaducts connected with any railway, either finished or in the course of completion, in Great Britain. The viaduct in question will cross Fairfield-street, better known, perhaps, as Travis-street, Manchester, or the Manchester and Birmingham line of railway. The great mass of substantial masonry against which the six ribs that compose the arch are intended to abut, is surprising to behold; perhaps anything more substantial, or work better executed, cannot be exhibited in the kingdom. The weight of the iron consumed in this viaduct is 540 tons, and is comprised of six ribs, each 128 feet span. The viaduct is also very remarkable for its acute angle, such angle being 24½ degrees; the width of the street being only 16 yards, or 48 feet. The only erection at all approaching to this in the acuteness of its angle is one on the London and Birmingham line, which is 28 deg. So very correct have the masonry and iron works been executed to the plan and specification, that on fitting the last segment of the first rib it was found impossible to introduce a sixpence between the joints—*i. e.* before the screws that connect the two adjoining segments were tightened. In attempting, however, to fix the last segment in the first rib, before referred to, at noon on the previous day, it was found to be fully three-eights of an inch too long, caused, as it was afterwards proved, by expansion, arising from the heat of the sun—for on the following morning, early, and before the sun's rays could have any decided effect on the iron, it was found to fit its destined place with the utmost possible precision.—*Liverpool Chronicle.*

PROGRESS OF RAILWAYS.

LONDON AND BLACKWALL RAILWAY.

[In the first volume of the *Journal*, page 109, are some comments by an "Old Engineer," relative to the proposed working of the above railway—we now have an opportunity of giving the particulars as to how it is intended to work the line, which we select from the report of the engineers, Mr. George Stephenson and Mr. Bidder, read at the last half yearly meeting of the Proprietors of the Company.]

"In consequence of inquiries, which from time to time are made, we feel that some explanation is desirable respecting the mode to be adopted in *working* the railway, and we, therefore, trust, that a few observations to render this clear will not be out of place on the present occasion.

"It is, we presume, generally known, that you intend to establish several intermediate stations between London and Blackwall, although, by the direct course of the railway, the *distance* is little more than three miles and a half. This accommodation could not be afforded on so short a line if worked by locomotive engines, without either doing away with the velocity usually attained on railways, or by having recourse to more lines of rails, which would, of necessity, involve an increase of locomotive power, and add largely both to the permanent and current expenditure. By means, however, of stationary engines, the desirable object of working intermediate stations for the convenience of passengers is easily secured.

"The plan adopted to accomplish this, is as follows:—Assuming that between London and Blackwall there are three stations, A, B, and C respectively, then the trains starting from London, and drawn by the locomotive engines, would consist of at least four carriages; the carriages might be more numerous for every station, but, for the sake of perspicuity in the explanation, we will assume for each one carriage only.

"The foremost carriage will be that destined to go all the way to Blackwall—the second, that to station C—the third, that to station B—and the fourth, that to station A. In the transit to Blackwall, station A is first reached, but previous to arriving at it, the last or fourth carriage is detached from the train, and is stopped opposite that station, whilst the rest of the train is still progressing. The third carriage is detached and stopped in like manner at station B, and so on till the carriage for Blackwall has arrived at its ultimate destination. The engines then cease working, and the rope which has been drawn from London, and is to be the means of reconveying the carriages back, is in a state of rest. While remaining so, the carriages at their respective stations are loaded and attached for their return, so that in due time when the rope is set in motion by the London engines: all the carriages are started simultaneously. The carriage which was last in the train towards Blackwall, thus becomes the first, and is attached to the rope a mile or two nearer London than the most remote carriage; and as they are all attached to the same rope, they obviously travel at the same speed, though at such a distance apart. It then follows that the carriage from station A, arrives first in London and occupies the furthest portion of the depot:—then follows the carriage from station B, and so on until the last carriage from Blackwall has arrived, when the engines again cease working, the carriages being thus left in their proper relative positions for their next transit towards Blackwall.

"To these arrangements the utmost effect will be given by the adoption of the Electric Telegraph of Professor Wheatstone and Mr. Cooke, similar to that which has been for a considerable period in successful action on the Great Western Railway.

"It is expected that the Railway when completed will afford equal facilities for the carriage of goods as of passengers; but its capabilities for the former description will not be fully developed, because until we have the double terminus in London, with the outlet on the one hand to the Dock Warehouses in Fenchurch Street, and on the other to Cooper's Row, adjoining Tower Hill, the conveyance of goods, confined as the discharge of them must be to the limited depot in the Minories, might be calculated to embarrass and interrupt the passenger traffic at that point."

North Midland Railway.—Between Derby and Rotherham (and on to Sheffield by the Sheffield and Rotherham Railway), the principal operation is laying the permanent road. A double line of rails is laid for a considerable distance north and south of Chesterfield; this part of the line will be opened early in May next. The following contracts are all completed, or very nearly so:—The Beighton, twelve miles north of Chesterfield; the Eckington, Whittington, Chesterfield, Northwingfield, and Clay Cross. On the line north of Beighton, and up to Rotherham, the Staveley, Southwingfield, Lodge-hill contracts, and down to Derby, great exertions are being made to have a double line for the opening, and a great portion of this distance is laid. The only earthwork remaining on this part of the line is finishing the sides of some of the large excavations, and completing an embankment at Bull-bridge, The stations will be completed shortly, as most of them are now roofed in.—*Notts paper.*

Sheffield and Manchester Railway.—We understand that this important line of Railway is at length about to be proceeded with in earnest. It is expected that the whole of the distance between Manchester and Glossop will be under contract during the present summer, and we think that if the Directors are supported in their efforts by the Shareholders, and supplied with funds to enable them to press forward the works with energy and spirit, they may succeed in completing and opening to the public that portion of the line in course of the summer of 1841, and thus secure at once a large and profitable traffic between Manchester and the populous manufacturing districts of Ashton, Staly Bridge, Mottram, Glossop, &c., besides that which they will derive by shortening the difficult road journey between Manchester and Sheffield.—*Liverpool Standard.*

Lancaster and Preston Railway.—We understand that the Galgate embankment, which is generally considered the heaviest work on the line, is at length finished. Mr. Locke, the engineer of the line, accompanied by the secretary, and other gentlemen, made a progress throughout the line, a day or two since, and expressed the pleasure they felt at finding the works in so forward a state. No doubt was expressed that the line would be opened for traffic early in the month of June, or indeed even earlier than that if any special occasion existed for the acceleration. Contrary to general report, Mr. Locke found the works at the Preston terminus in a still more forward state than any other parts of the line. The shareholders of the railway are in high spirits at the prospect held out by Mr. Justice Coleridge, of a return of a great portion of the assize business to Lancaster from Manchester and other places east of Liverpool, as promising a material increase to their returns.—*Lancaster Guardian.*

Travelling at the rate of Fifty-six Miles an Hour.—The ten-feet wheels attached to the locomotive engines employed on the Great Western Railway, not being found fully to answer the expectations of the directors, they have altered their plan, and in future, wheels of seven feet diameter only are to be employed. The result has been the attainment of the speed of fifty-six miles an hour. On Saturday the 28th March, the Fire Fly, a new engine on this principle, manufactured by Messrs. Jones and Company, of the Viaduct Foundry, at Newton, made an experimental trip from Paddington to Reading, and the following is a correct statement of her performance:—She left the station at Paddington at 13 minutes and 18 seconds past 11, A.M., and reached Reading at 59 minutes 43 seconds past 11, having past the first mile post at 11 hours 15 minutes and 57 seconds, and the thirty-fifth at 11 hours 58 minutes and 44 seconds, which is equivalent to one mile in one minute and 15½ seconds; or nearly 48 miles an hour. During the journey one of the tender springs broke, and caused some additional friction on the axles. The load was two carriages and one truck. At 3 hours 19 minutes and 9 seconds the party started on their return to London, with two carriages. They stopped to take in water at Twyford, which detained them 14 minutes and 44 seconds, and finally arrived at Paddington at 21 minutes and 3 seconds past four o'clock. The twenty-ninth mile post from London was passed at 3 hours 44 minutes and 50 seconds, and the second at 5 hours 16 minutes and 51 seconds, which is equal to the speed of 1 mile in one minute and 11¼ seconds, or an average 50½ per hour. The greatest speed attained was from the 26th to the 24th mile post, which was done at the rate of 56 miles an hour. This is the greatest speed at present attained in the history of locomotive power—what will ultimately be the greatest, it is impossible to foretell. Messrs. Jones and Co. have since forwarded a second engine from their works to London, and they have four others in process of erection for the use of the Great Western Railway Company.—*Manchester Courier.*

Midland Counties' Railway.—The works on this line as far as Leicester are in an extreme state of forwardness, and there is not the slightest doubt the first week in May will see the train flying over the high embankment, or through the deep cuttings, to that place. From Long Eaton to Sutton Bonnington, two lines of rails are completed—the splendid bridge over the Trent being now crossed by engines and trains of waggons, and the tunnel being also quite passable. At Sutton Bonnington there is a deep cutting beside the church-yard, and a station is building, which will require some little work, but the number of hands employed will soon complete that. Past Normanton-on-Soar and Loughborough all is finished, the station at the latter place being a very large one; but at Barrow-upon-Soar there still remains considerable cutting to be done, one place being cut down to 50 or 60 feet and not being yet completed. At Cossington there is a little work, but at Sileby this is counterbalanced by there being a total completion, comprising several very high bridges, which support the line above the village streets, and also some exceedingly deep cuttings. At Syston, the bridges and station are also nearly finished, the latter being only one story high, but still very compact, and containing plenty of room. At Thurmaston, about a mile and a half from Leicester, a piece of embankment is yet to be laid, and about a mile from Leicester there is some embankment required, but near to Leicester the works are in an extreme state of forwardness. The station is a noble one; the front facing the street is supported by five huge iron pillars. The engine house, depot for carriages, workshops for engineers, &c., are on a most extensive scale.—The bridges across the railway at Leicester, viz., across the Humberstone-road, London-road, &c. are finished, but at the top of New Walk, a tunnel is being built which will require some time to complete. About a mile and a half past Leicester, a very fine viaduct is in course of erection; and at Rugby another viaduct, not equalled by any in the kingdom for workmanship, is finished. In short, on the whole, the line may be fairly said to have sprung into being, so quick has been its progress. A new plan has been adopted at Leicester in building the bridges, viz., to build the side walls so high as to prevent any one looking over, and thus at the same time protecting numbers from accidents. The process of blasting is much practised at Leicester. In conclusion, we are sorry to add, that within the last fortnight two men have been killed on the works at separate times. A horse was also killed on Tuesday morning week, by falling down an embankment. The Directors intend giving a grand opening day when the trains run to the Rugby station for the first time.—*Notts Review.*

Edinburgh and Glasgow Railway.—This line of railway is getting on rapidly, and the tunnel in Bell's Park is getting forward at a quick rate. There are three steam engines employed at this tunnel bringing up the stones and rubbish at three holes, technically called "eyes," and a great quantity of stuff is brought up in the course of a day.—*Glasgow Chronicle.*

Great Western Railway.—This line was opened on Monday, March 30, for public traffic as far as Reading; and the day being unusually fine, attracted a large concourse of people there to witness the arrival of and department of the trains. The Company appear to have made the arrangements at this station conducive to the comfort of the passengers, as well as to the facility of carrying on a very considerable traffic in that important town. On Saturday last the Directors went down for the purpose of finally inspected the station and line, previously to their being opened to the public. The train, consisting of two carriages, and a truck, with about forty persons, left Paddington at eleven o'clock with the *Fire-Fly* engine, and reached Reading, a distance of 35½ miles, in 45 minutes, being at the rate of 47½ miles per hour. On their return with the same engine and train, after stopping at Twyford for water, they travelled the whole distance of 30¾ miles, from that station to Paddington, in 37 minutes, being an average speed of 50 miles per hour. The maximum speed obtained was at the rate of 58 miles per hour.—*Daily papers.*

South Eastern and Dover Railway.—A report has been industriously circulated by a cotemporary that a great number of men have been discharged from the tunnel works of this railway in our neighbourhood, which is calculated to create a suspicion that the company is in difficulties. We are happy, however, to be enabled to find, on the most minute inquiry, that such a presumption is entirely void of foundation. It is true that a few bricklayers have been discharged, owing to a limited supply of bricks on the part of the contractor; but at the same time, nearly 200 additional workmen have been set on at the contracts extending from Abbot's Cliff to Folkestone. On a personal inspection we find the work in a most promising condition. The Shakspeare tunnel will, we doubt not, be completed by the end of May. A large portion of the sea wall is nearly finished, and the Warren contracts are proceeding as well as the nature of the ground will permit.—*Dover Chronicle.*

NEW CHURCHES, &c.

Staffordshire.—The foundation stone of a new Church on the estate of Earl Talbot, at Salt, near Stafford, was laid on Thursday, March 26th, by his Lordship's daughter, the Marchioness of Lothian. The edifice will be built of stone in the Gothic style, and will accommodate about 250 persons.

Birmingham.—On Tuesday, March 31, the foundation stone of the new church of St. Mark, being the second of the ten churches proposed to be erected in Birmingham, was laid by James Taylor, Esq., in the presence of a large and respectable body of spectators. The spot chosen for the edifice is a beautiful and commanding site near the Sandpits gate. Messrs. Scott and Moffatt, of London, are the architects; and Mr. C. J. Brailsford, late of Huddersfield, is the builder; Mr. G. David, of Lichfield, being appointed clerk of the works. The church will be built entirely of stone, obtained from the quarries of J. F. Ledsam, Esq., of Weoley Castle, and will contain one thousand sittings, one-third of which will be free. It will be erected in the early English style of architecture, and though the moderate sum for which the contract is taken (£3,000,) will not admit of much costly decoration, the edifice will present, when finished, a very chaste and elegant appearance; and the committee have every confidence that the work will be completed in a substantial and satisfactory manner. The church will, we understand, be finished by the 1st of May, 1841.—*Midland Counties Herald.*

New Episcopal Chapel at Camborne.—On Tuesday the 10th March, the foundation stone of this building was laid by the Venerable Archdeacon Sheepshanks. The chapel, (designed by, and being built, under the superintendence of Mr. Wightwick,) is in the Early Pointed style, exhibiting, in no stinted degree that appropriately ornate character which should distinguish every building of its class. Indeed we understand it was to this end that Mr. Pendarves increased his subscription from £300 to £500. The building is intended to accommodate about 330 persons, of whom not less than 200 have their sittings free. The total length of the interior, (including the chancel and choir projections at the east and west ends) is about 82 feet; the width of the main chapel 30 feet; and its height 31 feet. The interior will derive its chief effect from the exhibition of the timbers of its ornamental roof, and the lofty arches opening before the triple windows of the chancel and choir. The approved success of this fashion in the chapel at Bude Haven, erected some years back by the same architect, has induced him to repeat it in the present instance. The chapel is expected to be completed in eighteen months from the present time.—*Plymouth Herald.*

Rome.—The Viceroy of Egypt has offered to the Pope four magnificent columns, each upwards of 13 feet in height, cut from a quarry of alabaster, discovered a few years ago. They are intended to adorn the new church of Saint Paul at Rome. This splendid present has been accepted by his Holiness, and is to be conveyed to Rome at his expense.

PUBLIC BUILDINGS, &c.

Cornwall.—The new Market Houses at Bodmin, Cornwall, are fast approaching towards completion. This building will form a most conspicuous improvement to the main street of the town, as it is erected upon a site of land formerly occupied by several ruinous tenements with projecting pent houses. The front is built of granite, the centre part or entrance being formed by four massive pillars in single blocks, with architraves over, 14 feet long each, weighing nine tons each; indeed, this front may be likened unto Stonehenge, as, with the exception of the ashlar and cornice, it may be said to consist of 13 massive blocks. In the architrave over the pillars are sculptured oxen heads, taken from the antiquities of Delos. The shamble fittings are to be iron, and the front enclosed with three pair of handsome iron gates. The cost of the erection will be about £3000. William Harris, Esq., of Bristol, is the architect.

Cornwall.—The new Town Hall at Helstone was opened for public business on the 14th of April, by the Recorder. This erection is in the Grecian Doric style, and cased entirely with Constantine granite; the front is composed of a basement having three entrances, viz., two to the corn markets, which are under the Guildhall, and one to the Guildhall. Above the basement are fluted granite Doric columns and pilasters, with entablature over and sculptured pediment, consisting of a clock in the centre, the band of which is composed of oak leaves and acorn-wreaths, and upon each side, forming supports, figures of St. Michael and the Dragon, being the town arms, which have been ably pourtrayed by Mr. Thos. Tyley, Sculptor, Bristol. The new General Market Houses in this town are now quite completed, and, together with the Town Hall and Corn Markets, reflect great credit upon the architect, William Harris, Esq., of Bristol. The cost of the Market Houses and Town Hall, including all expences, £6000.

MISCELLANEA.

Burning Coal Mines.—Letters and papers from the department of the Allier, bring accounts of a remarkable conflagration which broke out in the coal mines of Commentry, on Sunday the 15th March, and had been burning for a week with daily increasing fury. It appears that this fire, which, for the last four and twenty years, has been silently smouldering in the bowels of the earth—revealing its existence by perpetual smoke, and occasional outbreaks of flame, which, however, had always been confined within the limits abandoned to its dominion—had, at length, made its way through some breach into one of the vast galleries of these extensive workings; and there, meeting with the air-current so long denied it, had spread through all the subterranean chambers and passages with a rapidity before which resistance became utterly powerless; showing itself at every crevice and outlet of the vast labyrinth, and flinging its points and columns of fire far up into the air, through all the shafts that led into the wide field of the rich deposit. Luckily the solemnities of the day had emptied the workings of their human tenants, for no mortal aid could have availed them against the suddenness with which the fiery flood swept over all things. The authorities of the district were early on the spot, but have hitherto been little more than idle and awe struck spectators. Neither Vesuvius, nor any other irruption, say the accounts, can give a notion of the dreadful and sublime scene. "If," says one writer, "it were possible to forget that the flames have been, three whole days, devouring immense wealth, and that by this conflrgration three hundred fathers of families will be thrown out of employment, there would be room for no other sentiment than that of admiration at the magnificent spectacle. Imagine a deep ravine, nearly circular, in the form of a reversed cone, with its edges, however, hourly enlarging. Through fourteen large openings, issuing at about twenty feet above the ground of this ravine, and giving access to the innumerable galleries of the mines below, as many torrents of flame are poured forth, with frightful violence from the cauldrons within—flames of a thousand hues, rushing forth like fiery whirlwinds—dividing, and crossing, and mingling, and rising, and falling, and rising again! At times, a hollow cracking sound echoes through the abyss; this is some huge block of coal detaching itself from the roof or sides of one of the galleries, and falling into the blazing gulf. Then rises up a thick column of black dust, till it reaches the openings of the galleries, where, pierced in all directions by the flames, long serpents of fire work through its volume from side to side. Sixty feet higher up, on each side of the galleries, two gaping mouths shoot into the air their dazzling columns of fire. Suddenly one of these ceases. It seems for a moment, as if checked in its wrath. Then comes a long and startling groan from the entrails of the earth; and forth again rushes the flame, blood red, roaring and terrible, threatening in its fury to lift up the burning mountain altogether, and bury the spectators beneath its dreadful ruins. Again, look around you; it is midnight, and two thousand human faces are there, some grouped on the opposite crest of the ravine, some sheltered in the cavities of the rocks. Yet no sound meets the ear save that of the roaring flames." The latest accounts states that the rafters of the galleries had all fallen, and the founts of flame nearly ceased to play. The whole had become one huge burning gulf. The loss is said to be incalculable; millions of hectolitres of coal had been consumed. The engineers were preparing to turn the course of a stream, which flows at a league's distance, and direct it upon the burning mountain. Workmen were employed night and day in this operation, by which it was hoped to lay the mines under water.—*Athenæum.*

The Brick Trade.—It has been recently ordered that in estimating the duty, the size of the brick shall be measured in its dry, and not in its moist, state, as hitherto. Those familiar with the manufacture of bricks will at once see the fairness of the regulation, as some clays pine in much more than others.

Model of the Church of St. Peter.—We beg to call the attention of our readers to this most elaborate work of art, which is now exhibiting in the Gallery in Maddox-street, opposite St. George's Church, Hanover-square. It is the work of Celestino Vai, who has had the boldness to come to this country, trusting in the hope that he might reap an abundant harvest, and we most heartily wish him all the success the great merit of his model entitles him to expect. We can truly say, that it gives a more satisfactory idea of the celebrated original—of its beautiful proportions and enormous size—than any painting could possibly do. It is, therefore, a most interesting exhibition, not only to those who have had the good fortune to have seen Rome, but to that class more particularly who are untravelled. It is executed in wood, on the scale of 1 to 100, and consequently takes up a considerable space in a very large room. The fidelity and beauty with which every architectural ornament is rendered, is truly surprising, and this is more particularly evinced in the numerous statues that ornament the building. Every one of these represents a different attitude, and their number, amounting to between 500 and 600, renders them an amusing study. We may here observe, that the artist has represented the building as the architects intended it to be, but, as the church is not yet finished, he has executed a much greater number of figures than are now actually placed on the building. In the centre of the piazza is the Egyptian obelisk, which rises to the height of 134 feet. Its structure of red granite is exactly imitated. The fountains too are there, and the grand flight of steps which leads to the vestibule, and all about are scattered little diminutive figures, which will serve to show the relative size of the building. The colonnades next attract the attention, and although in our opinion they are out of place, yet the fame they have acquired the architect, Cellini, is well deserved. Above all we were attracted by the glorious dome of Michael Angelo, which is indeed a wonder to look upon. This exhibition cost the artist (Vai) a labour of 11 years, to him a labour of love. The room is surrounded by a clever panoramic sketch of the most interesting objects in the immediate vicinity of this most celebrated church.

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 30TH MARCH TO 23RD APRIL, 1840.

Claude Joseph Edmeu Chaddron Junot, of Brewer Street, Golden Square, Operative Chemist, for "*certain improved processes for purifying and also for solidifying tallows, grease, oils, and oleaginous substances.*"—Sealed March 30: six months for enrolment.

Henry Martin, of Morton Terrace, Camden Town, for "*improvements in preparing surfaces of paper.*"—March 30; six months.

William Neale Clay, of Flimby, Cumberland, Gentleman, for "*improvements in the manufacture of iron.*"—March 31; six months.

John Leberecht Steinhaneser, of Upper Islington Terrace, Gentleman, for "*improvements in spinning and doubling wool, cotton, silk, and other fibrous materials.*" Communicated by a foreigner residing abroad.—March 31; six months.

Peter Bancroft, of Liverpool, Merchant, and John Mac Innes, of the same place, Manufacturing Chemist, for "*an improved method of renovating or restoring animal charcoal, after it has been used in certain processes or manufactures to which charcoal is now generally applied, and thereby recovering the properties of such animal charcoal, and rendering it again fit for similar uses.*"—March 31; six months.

Charles Cummins, of Leadenhall Street, Chronometer Maker, for "*certain improvements in barometers and sympiesometers.*"—April 2; six months.

James Stead Crosland, of Leeds, Engineer, "*for certain improvements applicable to locomotive and other steam-engines.*"—April 2; six months.

Thomas Smedley, of Holywell, county of Flint, Gentleman, "*for improvements in the manufacture of tubes, pipes, and cylinders.*"—April 4; six months.

Harrison Blair, of Kearsley, Lancaster, Chemist, and Henry Hough Watson, of Little Bolton, Chemist, "*for an improvement or improvements in the manufacture of sulphuric acid, crystallized soda, and soda ash, and the recovery of a residuum or residuums, applicable to various useful purposes.*" April 6; six months.

Richard Beard, of Egremont Place, New Road, Gentleman, "*for improvements in printing calicoes and other fabrics. Communicated by a foreigner residing abroad.*"—April 6; six months.

Edward Thomas Bainbridge, of Park Place, Saint James', Gentleman, "*for improvements in obtaining power.*"—April 13; six months.

Thomas Young, of Queen Street, in the city of London, Merchant, "*for improvements in lamps.*"—April 13; six months.

James Caldwell, of Mill Place, Commercial Road, Engineer, "*for improvements in cranes, windlasses, and capstans.*"—April 15; six months.

John Gold, of Etna Glass Works, Birmingham, Glass Manufacturer, "*for improvements in the manufacture of decanters and other articles of glass.*"—April 15; six months.

William Potts, of Birmingham, Brass Founder, "*for certain apparatus for suspending pictures and curtains.*"—April 15; six months.

Louis August de St. Sylvain Baron de Los Valles, of Nottingham Street, Mary-le-bone, "*for certain improvements in cleansing, decoticating, purifying, and preserving corn and other grain. Communicated by a foreigner residing abroad.*"—April 15; six months.

William Grimman, of Camden Street, Islington, Modeller, "*for a new mode of wood paving.*"—April 15; six months.

Joseph Whitworth, of Manchester, Engineer, "*for certain improvements in machinery or apparatus for cleaning and repairing roads or ways, and which machinery is also applicable to other purposes.*"—April 15; six months.

Thomas Robinson Williams, of Cheapside, Gentleman, "*for certain improvements in obtaining power from steam and elastic vapours or fluids, and for the means employed in generating such vapours or fluids, and also for using these improvements in conjunction with distillation or evaporation, and other useful purposes.*"—April 15; six months.

William Unsworth, of Derby, Silk Lace Manufacturer, "*for an improved tag for laces.*"—April 16; six months.

Samuel Wilks, of Darleston, Stafford, Iron Founder, "*for improvements in the manufacture of vices.*"—April 16,; six months.

William Henry Bailey Webster, of Ipswich, Surgeon, R. N., "*for improvements in preparing skins and other animal matters for the purpose of tanning, and the manufacture of gelatine.*"—April 16; six months.

Samuel Marlow Banks, of Bilston, Stafford, Gentleman, "*for improvements in the manufacture of iron.*"—April 16; six months.

Robert Cooper, of Petworth, Gloucester, Gentleman, "*for improvements in ploughs.*"—April 16; six months.

Francis Molineux, of Walbrook Buildings, London, Gentleman, "*for improvements in the manufacture of candles, and in the means of consuming tallow and other substances for the purposes of light.*"—April 23; six months.

Elijah Galloway, of Manchester Street, Grays' Inn Road, Engineer, "*for improvements in steam engines, which are also applicable to engines for raising and forcing fluids.*"—April 23; six months.

Jonathan Sparke, of Langley Mills, Northumberland, Agent, "*for certain improved processes or operations for smelting lead ores.*"—April 23; six months.

John White, of Manchester, Engineer, "*for certain improvements in vices.*"—April 23; six months.

James Malcolm Rymer, of Henrietta Street, Civil Engineer, "*for certain improvements in castors for furniture, such improved castors being applicable to other purposes.*"—April 23; six months.

TO CORRESPONDENTS.

The sketch of the gothic window at Clomel Church is received, and will be noticed next month.

We do not consider Mr. Coles' *plan for propelling steam boats on canals is practicable; besides, the outlay required to carry it into execution will be too large to induce any canal company to adopt it.*

"A Subscriber" *is informed that there is a society called "The Contractors Association"*; Mr. Barry *of Manchester is the secretary.*

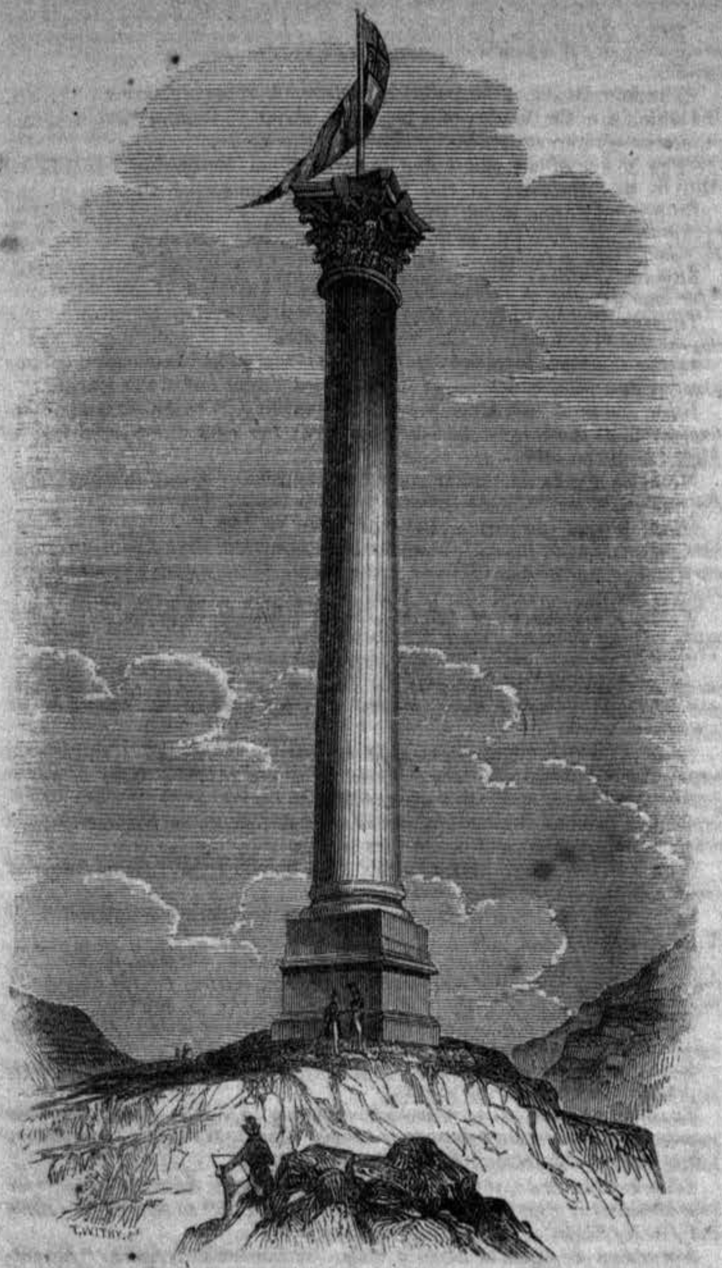
W. J. B.—*We do not think, being admitted into the Institution named will be of much service to him, until he has had some practice in a respectable office. We regret that we cannot give any advice that will be beneficial to him, for the object he wishes to attain.*

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No. 11, Parliament Street, Westminster.*

Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold, Price 17s.

⁂ The Second Volume may also be had, Price 20s.



VIEW OF THE COLUMN NOW ERECTING BY GENERAL BROWNE CLAYTON, ON THE ROCK OF CARRICK A DAGGON, COUNTY OF WEXFORD, IRELAND.

The column is a fac-simile of Pompey's Pillar, but not monolithic' it is being constructed under the directions of Mr. Cobden the architect' of granite, from the county of Carlow, with a staircase up the centre, the situation upon which it is erected is a considerable eminence above the sea, and when finished will form a conspicuous land mark for mariners. The following are the principal dimensions of the column, height of base 10 ft. 4 in., shaft and base 73 ft. 6½ in., capital 10 ft. 4½ in., total height 94 ft. 3 in., diameter of shaft at the base 8 ft. 11 in., and at the top 7 ft. 8 in.

"This column is to commemorate the conquest of Egypt, and the events of the campaign under the command of Sir Ralph Abercromby, K.B., in the year 1801, when General Browne Clayton, (then Lieut. Colonel), commanded the 12th Light Dragoons, and afterwards commanded the cavalry in pursuit of the enemy to Grand Cairo, taking besides other detachments a convoy in the Lybian Desert, composed of 600 French cavalry, infantry, and artillery, commanded by Colonel Cavalier, together with Buonaparte's celebrated Dromedary corps, one four pounder, and one stand of colours, and capturing 300 horses and dromedaries, and 550 camels.

"The events of this campaign are further to be commemorated, by the appointment of trustees under the will of General Browne Clayton, who shall annually at sun rise on the morning of the 21st of March, (when the French under the command of General Menou, attacked the British encampment before Alexandria), raise the standard on the column, and hoist the tricolour French flag which shall remain until the hour of 10 o'clock, when the British flag shall be hoisted and kept up until sunset, as a memorial of the defeat of the French, which event forms the prelude of Britannia's triumphs through a regular and unbroken series of glory and prosperity down to the battle of Waterloo, in 1815. And on the 28th of March annually, the British flag shall be hoisted half standard high as a memorial of the death of the brave commander-in-chief Sir Ralph Abercromby, who died of the wounds which he received before Alexandria, on the 21st of March 1801."

WYRE LIGHTHOUSE.

Description and structure of the Wyre (Seaward) Lighthouse, leading to Port Fleetwood.[*]

It was my study when planning this navigation to identify the remotest spit of bank turning into it, without subjecting the mariner to the treacherous, and, at best, but partially-lighting agent, a *Light Vessel;* Messrs. Alexander Mitchell and Son, of Belfast, readily took up the proposition, and the Board of Directors of the railway and harbour project, as readily adopted the application of Mitchell's ingenious mooring screw[†] to the insertion and basing of piles or pillars, in sub-marine foundation. I had given much trouble to Messrs. Mitchell, when unavailingly submitting their plans and specifications to the Liverpool Dock Committee, (Oct. 4, 1838,) of so perfect a mode of establishing lights *out upon the very* banks of a navigation, whereby the power and object of a lighthouse is enhanced by proximity with the anxious observer from sea. In fact, a lighthouse can be thus erected upon any *under-water* spit, as indifferent to a 30-feet rise of tide and channel surge, whilst sending forth its light of the same character and stability, as if on the main land; thereby throwing it more intensely and effectively *on the region required*, especially where shoals out-lie the main to any extent. Its time in erection, the shortest possible,[‡] and of so portable a structure that it may be removed, if local changes require, to another site in a month. Wherefore, then, should not every spit, now guarded by a light-vessel, with her unavoidably inferior order of lights, rendered more so in a gale of wind by pitching, floundering about, and ever and anon submerged in the trough of sea, spray, and spoon-drift, and that too when most wanted, and often at the very crisis of exigency to all around, *breaking adrift!* Wherefore not supersede them by so purpose-like a fabric? Let those who take interest, but who doubt or cannot conceive the matter, go to Fleetwood-mount Observatory, commanding the mouth of Wyre, and watch the effects of a westerly gale upon the first of its kind, (not associating the effects of a sea-way upon the Eddystone or Bell Rock, for the screw-piled pillars *do not oppose* the sea). A structure destined to save many a gallant bark that would otherwise drive, unbeaconed and unwarned, upon the sands of Morecambe Bay, and I doubt not will give rise to a general adoption; whilst rendering it imperative on local guardians of a navigation, to establish REFUGES for the cast-away mariner, on the isolated banks; since, by this method, the practicability is manifested. Indeed, this sub-marine method of commanding foundation and *hold-fast*, so ingeniously contrived by Messrs. Mitchell, combines the vital essentials to the seaman's hope, of *warning, guiding, succouring*, and, when in port, *securing!* The figure of this first '*Screw-pile*' Lighthouse in the United Kingdom,—in the world I may say, is shown in the annexed engraving, and presents to the eye a well-proportioned group of columns rising out of the sea, in the intervening and over-lapping order that hexagonal or six-angled figures produce, according to the separate angles you may be opposite to; a systematic interlacing of tension-rods renders the fabric sufficiently opaque, even below the platform; but above the platform, of 27 feet diameter, you have a six-angled dwelling-house of 20 feet diameter, by 9 feet high; on the centre of which rises the 12-sided lantern, with Chinese roof, of 10 feet diameter. Thus, you have a figure of 46 feet spread at the base, contracting at the platform balcony to 27 feet, and elevated 45 above low-water level; surmounted, as stated, by a bulky, yet pleasing and effective, superstructure, comprising a comfortable residence for the light-keepers, whilst affording you a steady, bright, *uniform* light, 45 feet above mean-sea level,—ranging over an eight-mile horizon, visible 10 miles from a coaster's deck, and freed from those *breaks* of brilliancy attending the offing passage from reflector to reflector, by being fitted with a light of '*Dioptric*' order. Foggy periods are provided for by a self-acting deep-sounding bell, tolling three strokes of five-second intervals, at one minute pauses; and tide-time for vessels of 12-feet draft, is denoted by 2 black balls being kept upon its flag-staff until 12-feet ceases upon the *straight course, right up;* at the same time, however, denoting 17 feet up through the *buoyed* channel; and vessels requiring a Wyre pilot will be understood at this lighthouse, if showing a weft at the peak, besides their pilot-jack at the mast-head; whence, a pilot-jack will *also* be hoisted until she is provided. The Wyre pilot-boats are of sloop and yawl rig, with black bottom, *white* top-sides and black streak, with her number and the letter F on the mainsail. Their cruising ground extends from Formby Point to Havering Point of Duddan.

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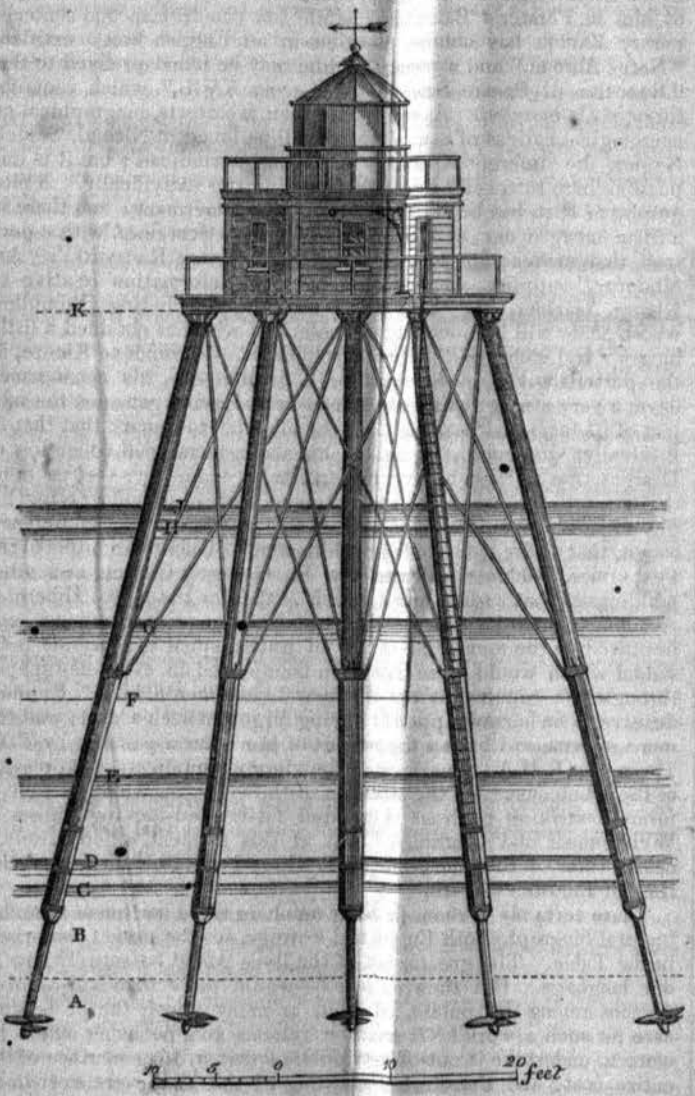
[*] We are indebted for this description and drawing to a very able work, by Commander H. M. Denham, R.N., F.R.S., lately published at Liverpool.

[†] See Journal, Vol. II., p. 38,

[‡] The Wyre Lighthouse was reared in two of the shortest-day months in the year, not affording *daylight* during a low-water period, spring tides, but depending on flambeaus or moonlight.

ELEVATION OF WYRE LIGHTHOUSE.



REFERENCE.

A, Marl formation; the screws are 10 feet below low water mark.
B, Sub-stratum of sand.
C, Low water equinoctial springs.
D, Low water ordinary tides, 2 feet above ditto.
E, Ditto neap tides, 9 feet ditto.
F, Half-tide level, 15 feet ditto.
G, High water neaps, 21 feet ditto.
H, Ditto ordinary tides, 28 feet ditto.
J, Ditto, equinoctial springs, 30 feet ditto.
K, Underside of platform, 45 feet ditto.
Centre of the Dioptric Light in Lanthern 60 feet ditto.

SPECIFICATION *of the above Screw Pile Lighthouse, erected on the north-eastern low-water spit of North Wharf Bank, at the entrance of the Wyre Navigation, the structure being supported upon, and secured to, the bank with Mitchell's Patent Screw Piles, of 3 feet diameter.*

The foundation of the building is formed of seven screw piles, six of which are the angles of a hexagon, about 46 feet in diameter, and the seventh pile stands in the centre of the figure.

The heads of all the outer piles have an inclination inwards, by which the diameter of the frame-work connecting the top of the columns, and upon which the house stands, is contracted to about 27 feet. Each screw pile is formed of a malleable iron shaft 15 feet long and 5 inches diameter.

On each pile a 3-foot screw is firmly keyed near its lower extremity, beneath which is placed a large drill or opening bit.

At the upper end of the shaft is a screw of 18 inches long and 2 inches diameter, for drawing down and screwing the wooden column to the iron pile, which latter stands about 5 feet out of the ground.

The columns are thus prepared;—seven logs of Baltic timber are selected, of the largest and best quality; the centre one is 56 feet in length, all the others are 46 feet.

The pedestals rise about a third of their height, and the remainder of the shafts are rounded, both for appearance and as lessening any vibration from the action of the sea.

An opening in the lower end of each column is then made of 5 inches diameter, and to the depth of about 8 feet, by boring in the manner of a water-pipe; strong iron hoops are then driven upon it, hot, the first about 8 feet up, the second about 4 feet, and the third at its lower extremity.

This hooping will give to the column greater strength than it originally possessed, especially as the wood removed by boring is the weakest in the tree, and adds scarcely any thing to its actual strength.

The column being raised perpendicularly above the iron pile, the end of the latter is introduced into the opening prepared for it, and which has been made to fit accurately upon it; when the top of the pile has reached the end of the cavity, screwing on (by capstan), the foot of the column will be inserted in the bank about 3 feet; the wood, when wet, will clasp firmly on the iron, but, as an additional security, the internal screw attaches the two together.

The framing upon which the house stands is firmly secured round the centre column, and to the heads of the outer ones, by means of cast-iron capitals let down over the heads of the columns, the capitals being cast hollow for the purpose; to the abacus of these the top framing is secured with screw bolts passing down through the wood and iron, having nuts on the under side, all boring or cutting into the main support of the building being thus avoided, and the adjacent parts of the framing are bound together by wrought-iron straps and knees; the beams which radiate from the centre to the heads of the outer columns are 12 inches deep by 7 inches wide, and those which connect the head of the outer columns, 12 inches by 4.

To give lateral strength to the building to resist the effect of heavy bodies drifting against it, twenty-four angle braces from round iron of 1¼ inch diameter are applied, as shown in the plan, by which a resisting power equal, at least, to 350 tons, is presented in every direction; these braces are secured at the top to trusses cast with the capitals, and beneath to strong wrought-iron bands with projecting bolt holes; by these means boring into the columns is again avoided, the braces are keyed up at their crossing, as shown in the plan.

The light-keepers' house, which is hexagonal, is in diameter from angle to angle 22 feet, and 9 feet in height.

The centre column rises to the base of the lantern, which, with the roof, it assists to support, giving great additional stability to the whole structure.

The corner-posts of the house are 7 inches by 6, all remaining studs 6 inches by 4, beams of roof 9 inches by 5, and all outside planking, together with floor and roof of house, is 2 inches thick.

The house has an outside door and three windows, and is divided into two apartments, one having a fire-place and the floor tiled; the walls and ceiling of both apartments are lathed and stuccoed.

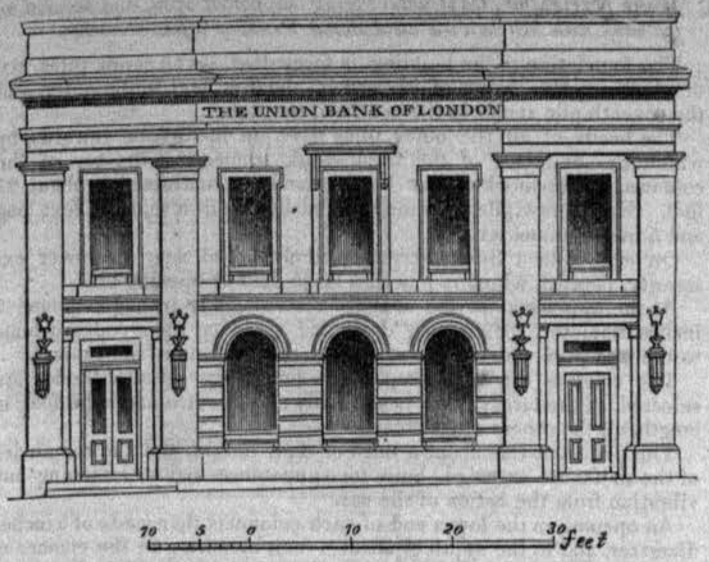
The lantern, which is 12 sided, is 10 feet in diameter, and in height to the top of the windows 8 feet, by which the lights are raised above the highest spring-tide level about 31 feet, or 44½ above half-tide level.

The lights (in this case of dioptric order) show throughout the periphery, and the roof is covered with strong sheet iron; (a lightening repeller and conductor, of course).

The light-keepers' house is covered with sheet lead, and a light iron railing is carried round the top of the building and the platform.

60, *Pall Mall, London,* HENRY MANGLES DENHAM.
Jan. 31, 1840.

THE UNION BANK OF LONDON.



THE Joint-Stock Banks promise like the Assurance Offices to give some employment to architects in the metropolis, as they have already done in the country. Any thing in fact is worthy of encouragement which rises above the mere brickbat and whitewash style. This building situated on the north side of Argyle Place, Regent Street, intended to form the West-end Branch Establishment of the Union Bank of London is nearly completed, from the designs and under the superintendance of Mr. William H. Newnham and Mr. George B. Webb, joint architects to the bank. Tenders for its erection were sent in by public competition last September, when that of Messrs. Turner and Sons, of Little Moorfields, being accepted by the Court of Directors, a contract was entered into with them for building it at the sum of £3860. It occupies a frontage of 70 feet towards Argyle Place, and is three stories in height. It contains on the ground floor, a banking office 28 feet long (exclusive of circular end towards Regent Street) by 20 feet wide, and 16 feet 6 inches high, divided at one end by a screen of Bath stone Doric columns and entablature from a lobby 20 feet by 6 feet, which communicates with the Directors' Committee-room, the Manager's, and the Waiting rooms. On the basement is a groined strong-room, 18 feet by 14 feet, washing-room, &c., for clerks, porter's room, and coal-vaults. The remainder of the house, is devoted entirely to the use of the Manager, who will reside on the premises, and comprises, on the first story, which is 13 feet high, a large drawing-room with circular Venetian window, a breakfast parlour, bed-room, and dressing-room, four bed-rooms and store-room on the second floor, with kitchens, wine, coal, and wood cellars, and other requisite accommodation on the basement.

Simple in its character, this building has a solidity of appearance which we trust is appropriate to the institution to which it is devoted, and it cannot fail to prove an ornament to the neighbourhood, and an example to other companies.

Dyeing Timber.—Amongst the subjects lately discussed in the French Academy of Sciences are, a discovery, by a Dr. Bourguet, for dyeing and preserving timber, and one for obtaining blue or red silk from silkworms. Dr. Bourguet states, that if the lower part of the trunk of a tree be immersed, as soon as it is felled, in a preparation of pyroligneous acid, the preparation will be absorbed throughout the whole of the tree, and that the timber will subsequently resist decay. He states, also, that if colouring matter be placed in the liquid, it will be carried through all the vessels of the tree, even to the leaves, and be permanently fixed. As this gentleman has made frequent experiments, there appears to be no doubt of the correctness of his theory. The mode of obtaining blue or red silk from silkworms is kept a secret, except as to an admission that it depends on the food of the insect. M. Flourens, a member of the Academy, had previously ascertained that the flesh, and even the bones of animals, may be coloured, by keeping them for a long period on food highly impregnated with colouring matter.

Bendable Stone.—In the Museum of the Asiatic Society at Calcutta, one object of curiosity is a bending or elastic stone. This stone is, apparently, of granite, is about two and a half feet by six inches in length and breadth, and about an inch thick. This stone, being lifted at one end, yields to the pressure, and from the half begins to bend as it is lifted, and as the lifted end is raised, the bend approaches nearer to the further extremity. On the lifting power becoming relaxed, the stone reverts to its former level.—*Calcutta Paper.*

TABLE OF ARCHITECTS.

SIR—There was more than one reason wherefore I did not give authorities for the names introduced in the Table of Architects. In the first place, I did not imagine any thing of the kind would be looked for, it not being usual to accompany Chronological Tables with similar references; in the next, an additional column would have been required for the purpose; and for reason the third, I was of opinion that to do so, would be considered coxcombical ostentation and fussy parade. I should have had to make out a catalogue of journals and books in nearly half-a-dozen different languages, Italian, Spanish, French, German, and Russian:—and to what purpose would it have been to have referred your readers to the Khudozhestzennya Gazeta for an account of Voronikhin, and of Thomond,—to the Entziktopetitzeskii Leksikon for a notice of Bazhenov, and so on? If your correspondent is desirous of meeting with a memoir of Don Ventura Rodriguez he will find one in Jovellanos' Works, but then unless he happen to possess the latter, where is he to meet with them?—certainly not in the British Museum. Of most of the other Spanish architects inserted in the Table, notices will be found in Llaguno and Cean-Bermudez, and Ponz. Relative to Quarenghi, some information may be found, prefixed to his Fabbriche e Disegni. Of Cagnola various notices have appeared in the Biblioteca and other Italian Journals, and there is also a memoir of him in Förster's Bauzeitung; while his countryman and contemporary Zanoja has obtained mention in an English work entitled "Notes Abroad," and a portrait of him may be found prefixed to the "Raccolta di Poesie Satiriche del Lecolo XVIII," which contains three of his *Sermoni*. As regards German architects, biographical or necrological notices of many of them will be found in Nicolai, Seidel, Nagler, the different Kunstblatts and other periodicals; but it is impossible here to specify the numerous authorities individually. A biography of Hirt, has been recently published in Germany; and there is a little meagre one of Weinbrenner by Aloys Schreiber, with a portrait that makes him look like a butcher. Count Raczynski's "Art Moderne," supplies us with some personal information relative to Klenze, Gärtner, and a few other architects, including Ohlmüller, whose name will be found in the table, and who has obtained a little biographical niche in the Penny Cyclopædia.—Apropos to Klenze, if the portrait given by Raczynski be a faithful one, his countenance bears a very strong resemblance to Nelson.—Having got upon the subject of likeness and portraits, I may be allowed to remark that that of Il Cavalier Quarenghi, prefixed to his above-mentioned collection of Designs, has a look of most imperturbable stupidity:—let us hope that the artist to whom he sate betrayed instead of pourtraying his physiognomy.—One omission in the Table lies heavy upon conscience, to wit, that of the name of Francis Johnston, of Dublin, architect of the Post Office, Richmond Penitentiary, St. George's Church, and other buildings in that capital, one of which is that for the Royal Hibernian Academy, which he erected in 1824 at his own private expense, and bestowed on the members;—an act of public spirit in a private individual which would here have been trumpetted in every newspaper through the country, as one of unparalleled munificence. I almost deserve to be horsewhipped for having forgotten such a man; and the more so because I have a fine portrait of him after a painting by T. C. Thompson, R.H.A., remarkable for the vigorous intellectual expression of the countenance and the animation of the eyes; on which account it forms a striking contrast to the dull fat-headed-looking phizes of Weinbrenner and Quarenghi. Just at this moment, unfortunately, I cannot refer to the Annual Register, where I could obtain the precise time of Johnston's death.

There certainly is room for doing much in the department of architectural biography both English and Foreign, for the period comprised in the Table. The greater part of the lives would be entirely new in our language. But then *cui bono?*—would more than half-a-dozen persons among the public, and about as many among the profession, care for such a work? It would be ruinous to a publisher unless he were to undertake it out of sheer public spirit, making sacrifice of the entire cost: and therefore if anything of the kind were ever to be attempted, it should be by such a body as the Institute.

W. H. L.

P.S. With regard to the names of Craig, Pilkington, Byfield, &c., whom another correspondent has pointed out as having been omitted in the Table, it is sufficient excuse to say that I have never met with them anywhere, therefore they can hardly be of any note, certainly not of any historical importance. A line must be drawn somewhere, otherwise, if all the illustrious obscure are to be included, any table or list of names would be amplified to the extent of a Court Guide, and would become quite the reverse of a synopsis for reference. Methinks, too, the party who has called attention to the above-given names, might, at the same time, have stated what are their claims to distinction.

WHITE'S PATENT BRICK AND TILE MACHINE.

Fig. 1.—Plan.

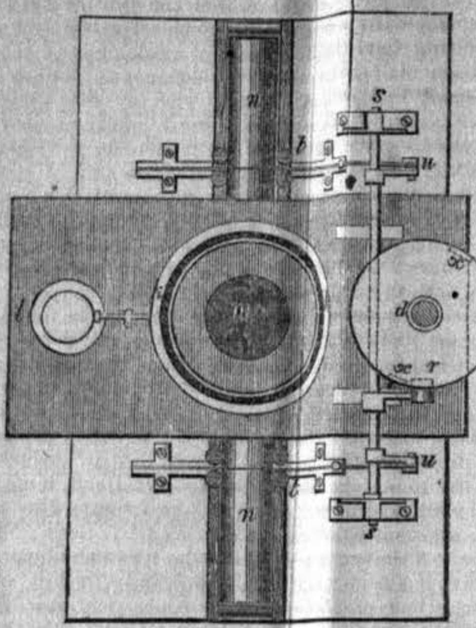


Fig. 2.—Elevation and Section.

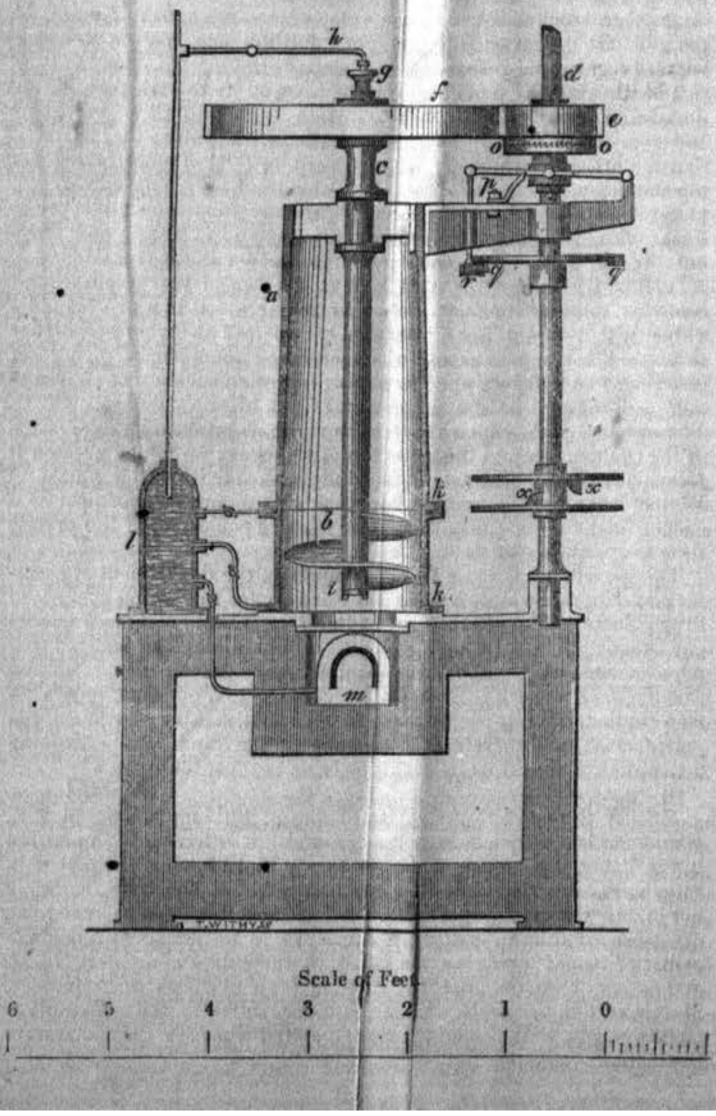


Fig. 4.—Section of Screw and Cutting Apparatus.

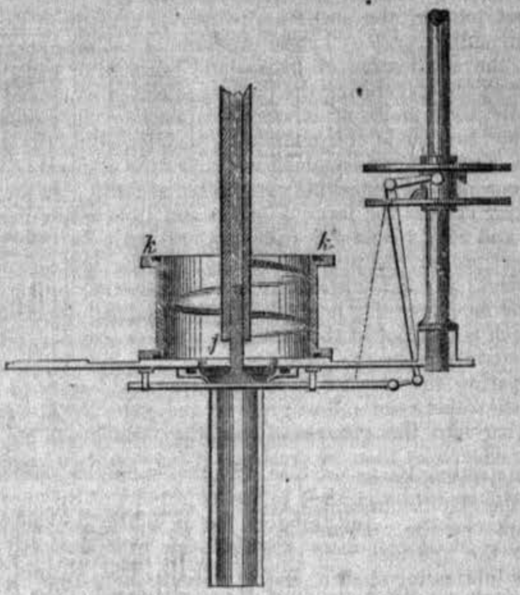


Fig. 7.—Section of pinning and clutch box.

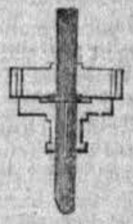


Fig. 8.—Plan of Tube-cutter.

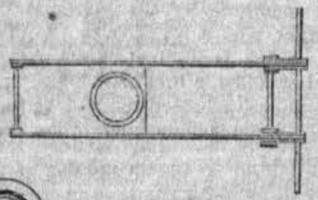


Fig. 6.

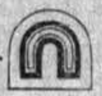
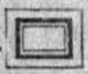


Fig. 5.



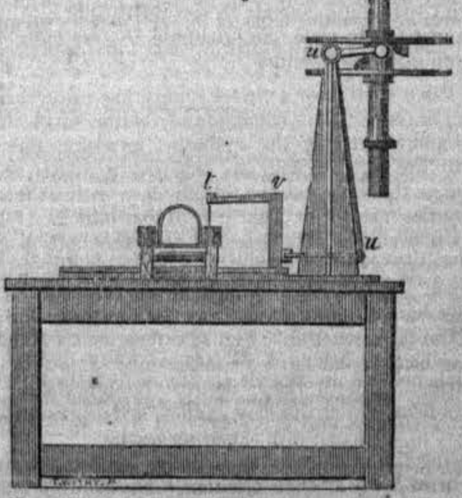


Fig. 3.—End view of Cutting Apparatus.

WHITE'S PATENT BRICK AND TILE MACHINE.

Specification of the Patent granted to James White, Lambeth, in the County of Surrey, Engineer, for certain Improvements in Machinery, for moulding Clay to the form of Bricks and Tiles, and for mixing, compressing, and moulding other substances.

THE first part of the invention relates to a mode of forcing clay through moulding orifices by the pressure of inclined surfaces. Secondly, to the application of hydrostatic lubrication to facilitate the movement of the clay during the process of compressing and moulding it. Thirdly, to a mode of mixing, compressing and moulding peat; and fourthly, to a mode of compressing and expelling the water from peat-moss, by the superincumbent weight of the atmosphere.

Fig. 1 is a plan of a machine constructed according to my invention for moulding clay to the form of bricks and tiles with a portion of it removed, and Fig. 2 is an elevation of the machine with several parts of it in section, for the purpose of showing the internal construction more clearly. Fig. 3 is an end view of the cutting apparatus which divides the moulded clay into the length required, removed from its place, which is in front of the machine. There are two, one on each side, as represented by the plan, fig. 1.

In preparing the clay for moulding, when necessary to crush it, I prefer to do so between rollers grooved and ribbed. The ribs of the one working into the grooves of the other, which will break up the clay more effectually than by crushing it between two rollers, having plain cylindrical surfaces.

When the clay has been prepared for moulding, it is conveyed into the machine by the aperture *a*, fig. 2, on an endless band or by a shovel, or the aperture may be lower down opposite the screw *b*, on the hollow lubricating shaft *c*, and the clay impelled into it direct by the force of the crushing rollers; in this case the screw may be placed in a horizontal position, and the aperture *a* be above it. The power which gives motion to the machine is applied to the vertical shaft *d*, and by means of the pinion *e* working into the wheel *f*, the screw and shaft *c* are put in motion. This shaft is supported and retained by one bearing at top, and the screw *b* is turned and fitted to the cylinder in which it revolves at bottom. There is a stuffing box *g* fitted to the top of the lubricating shaft *c*, which receives the end of the pipe *h* that supplies the chamber in the shaft with water. When the machine is used for making bricks and tiles a brass plate *i* is screwed on the lower end of the shaft *c*, and prevents the water which it contains escaping in that direction; but when it is used for making circular tubes, the plate is removed, and a plug *j* inserted, which forms the inside diameter of the tube as shown in fig. 4, and the water is then permitted to percolate that way. The clay is lubricated from the spiral plane of the screw *b*, by having a radiating channel from the chamber in the shaft *c*, into which very small holes are drilled, for the water to escape by. There are also lubricating joints, or channels, in the flanges at the top and bottom of the cylinder in which the screw *b* revolve, marked *k k*, in the different figures, and similar joints or channels are formed round the orifices or moulding openings, from whence the clay exudes from the machine by the propelling power of the screw; and I would state that these lubricating joints or channels, may be differently constructed without departing from my invention, so long as the application of hydrostatic pressure in supplying a fluid to them is retained.

Fig. 2, *l* is a section of a vessel containing water from which several pipes with brass cocks on them convey water to the lubricating joints in the top and bottom of the cylinder, in which the screw revolves, and also to the shaft *c*, and the lubricating orifice, in the chamber *m* from whence the clay exudes. The clay with which the machine is charged by the aperture *a*, fig. 2, is drawn into the spiral plane of the screw *b* as it revolves, and impelled into the bottom chamber *m*, from whence it escapes in two streams in opposite directions as shown in fig. 1, by *n n*. When different figures are required to be moulded, it is only necessary to change the chamber *m*, and apply one having an orifice of the form wanted. Fig. 5, is face view of a lubricating orifice for forming bricks, and fig. 6 a similar view of one for making common draining tiles. In both these figures the lubricating channels round the orifices from which the clay exudes, are represented by strong dark lines.

In dividing the moulded clay into the lengths required, the screw *b* makes a brief stop at that moment, and consequently the clay to be cut. The pinion *e* is loose on its shaft, and resting on a collar as shown in fig. 7, which is a section of the pinion and toothed clutch-box *o o*, which turns it. When the toothed clutch-box is withdrawn from the pinion, as will be presently described, the shaft *d* may turn, and the pinion *e* with the apendage it drives remain stationary, until the clutch-box is forced up again to its present position by the spring *p*. It is withdrawn twice every revolution of the shaft *d*, by two inclined planes *q q*, depressing the roller *r*, as they alternately pass over it, as may readily be understood by reference to the drawing. These planes *q q*, can be regulated to cut the moulded clay to any length produced from one revolution of the shaft *d*, simply by increasing their number or adding to the length of their planes. In addition to this mode of cutting various lengths by my machine, the horizontal shaft *s s*, of the cutting apparatus shown in fig. 1, can be extended and several cutting instruments *t t*, fixed at given distances from each other, and all of them made to operate at the same instant. The levers *u u*, give motion to the slide *v* which carries the cutting instruments *t*, as shown in fig. 3, at the time the clutch-box *o o* is withdrawn from the pinion *e*, by two quadrants or inclined planes *x x*, fixed on two circular plates shown on the shaft *d*. The dotted lines represent the vibration of the levers, and it will be seen that the clay is cut, and recut by their motion. Fig. 8 is a plan of the slide which is used for cutting circular tubes, it is moved by the horizontal shaft *s s*, vibrating two levers through openings in the top plate of the machine shown in fig. 1. In forming principal drains with these tubes, I recommend short circular soles to support them at the joints, the soles may be moulded after the manner described for making common draining tiles, and cut into short lengths by a circular saw after the clay is sufficiently dry for burning. The advantage of forming principal drains with circular tubes is very obvious. They are stronger with less material than any other figure having the same internal capacity, and they also offer to the water greater facility to escape, than would be the case if it were running over flat surfaces, in addition to which, the expense of procuring them is greatly diminished by my invention.

In the event of the machine fig. 1 and fig. 2 being employed for mixing, compressing and moulding peat, I apply knives on the screw shaft, and also round the circumference of the cylinder in which it revolves, making in fact an ordinary pug mill by which the materials will be mixed and blended together before they arrive at the screw, where such materials will be pressed and moulded into rectangular bricks, and may be cut by the apparatus described.

Another part of my improvements relates to the compressing of peat by the superincumbent weight of the atmosphere. To effect which I form a large vessel of any known material that will keep it sufficiently air tight, such as iron, slate, or stone, a few inches from the permanent bottom of this vessel, I place another full of small holes and support it on the former, above the one full of holes a layer of coarse cloth is spread, upon which the peat to be compressed is laid to about 12 inches deep. The length of the vessel is immaterial, provided it being sufficiently air tight. One, however, 200 feet long by 6 feet wide, would be a proper size for compressing about 40 tons of peat at one time. When the vessel has been charged, the peat is to be well blended together, which may be done after the manner clay is made to combine in forming the bottom of a canal when making it water tight, and it is also to be well pressed to the edges of the vessel, to prevent as much as possible the air descending by it, or through it, in a downward direction. When the top surface of the peat has been well secured against the admission of air, a communication is to be opened with an air pump, and the air exhausted from the space between the two bottoms which will cause a partial vacuum below the peat, and thereby offer to the water which it contains great facility to escape. At the same time the pressure of the atmosphere on the top surface of the peat will be in proportion to the exhausted state of the air below, and the whole mass will be compressed, and the water which it contains will be carried away by the air pump, after the manner the air pump of a condensing steam engine performs its office.

When the peat has remained in the vessel or pit sufficiently long to be reduced to about one-third of its original depth, it is to be removed and properly dried by any of the modes in use. In removing it, it may be readily cut into regular sizes by having a carriage to pass over it with knives projecting downwards, and so placed as to divide it into a number of slips about 4 inches wide, and these may be cross-cut into lengths of 8 inches, which is found to be a good size for drying.

Having described my improvements for moulding clay to the above mentioned purposes, and also for compressing peat, I wish it to be understood that I do not claim any of the parts, which are well known and in use for moulding clay and compressing peat; but what I do claim as the first part of my invention, is the application of the inclined surfaces of a screw to press clay through moulding orifices as above described. Secondly, I claim the mode of stopping the moulded clay while it is being cut as above described. Thirdly, I claim the mode of lubricating the clay with water when being moulded by pressure through moulding orifices as above described. Fourthly, I claim the mode of mixing, compressing and moulding peat by means of a pug mill when combined with a screw to compress and mould the peat through moulding orifices as above explained: and lastly, I claim the mode of compressing peat by the pressure of the atmosphere, and separating the water from it by a pump as above described.

James White.

11, *East Place, Lambeth.*
May 12, 1840.

ON THE HORIZONTAL AND PERPENDICULAR LINE IN ARCHITECTURE.

By Frederick East, M.A.

I was at the Institute the same evening that Sir Gardnor Wilkinson, a gentleman of great acuteness, tendered to its members certain impressions produced upon his mind by the prevalence of the horizontal or perpendicular line in architecture. Sir Gardnor, however, from a certain politeness of feeling, did not extend his observations to any length. He conveyed them rather in the shape of suggestions, with a view to elicit from the profession more enlarged views upon the subject. Probably in harmony with that wish it was that Mr. Godwin entered the field, and favoured us at the last meeting with a passing and pertinent criticism upon the perpendicular line. But the bearing of his criticism affected the frequent use of a column breaking from the main entablature and exhausting itself in a figure. He considered it as a mere excrescence, giving perhaps too much importance to sculpture, which I conceive most will admit as only accessory and secondary to the design. Hence it was employed without judgment or feeling when evidently a mere prop or support for the statue. His observations seemed, however, limited to this; they appeared to penetrate no farther than to show this fallacy in taste. I can only regret from the clearness and conciseness of those remarks that he did not anticipate my own, and that the subject was not more indulgently treated by one so much more competent to give them.

Feeling, however, that it is expedient to detect the true spirit of a composition, and of the minutiæ which compose it, in order to guide our own taste; and that no satisfaction can result from the mere knowledge of the existence of this or that style without we can apply it to our own erections, if harmonious, or shun it, if discordant; I humbly introduce my own impressions on the subject, which I offer, however, with submission to the profession, as before men, some of whom are no doubt perhaps more fitted to impart information, than to receive the slightest observation, or the smallest wrinkle from me.

By a consideration of the prevalence of these lines, so marked, and prominent in the palaces and churches of Italy, in the middle ages, we naturally trace out the real secrets of beauty in foreign creations, and are enabled to judge whether they accorded with the spirit of the times, and consequently with the beauties of real expression, as it was then influenced. By this means we may avoid passing a hasty censure upon that which to an edifice in this country would be certainly destructive to true taste, and which we could never imitate but under similar circumstances.

Notwithstanding the correctness of Mr. Godwin's remarks, I conceive a more powerful motive, than to give effect to sculpture, influenced the adoption of the perpendicular line, in the purer days of art. And that however a series of columns might have been afterwards sacrificed to the beauties of a figure or the ornaments of sculpture, their use sprang originally from the poetry of nature and the resources of Italian fancy.

I conceive that great poetry and pathos—pleasing emotions, or gloomy ideas are consequent upon a skilful appropriation of the perpendicular or horizontal lines. A partiality for the former when decked with the garlands of nature, enlivening us with gaity and mirth, and exhibiting in its tapering lightness, all that seduces and captivates; whilst great indulgence in the latter instils awe and inspires some idea of the terrible and sublime.

To illustrate my meaning more clearly, I would make solid simplicity, weight, dignity, &c. to repose upon the horizontal, whilst elegance and grace should seek their beauty from the perpendicular. Because there seems to me something of phisiognomy in architecture,—a character about it—so that we are either amazed, awed, softened, or delighted, by its mien and general bearing.

When therefore we search after grace, nature reveals it, sporting and skipping in lightness and elegance, never so beautiful as when in action and erect, seldom shortened into repose. Hence the taperings of the Gothic, and the careless lightness of the Corinthian. Hence also the prevalence of the perpendicular, which might tend to insignificance in a building, but for a certain symmetry of parts, easily detected in works of acknowledged merit. But to fashion the grand, the solemn, the imposing edifice, we instinctively turn from any thing feminine or slight. Like laughter and mirth they become noxious to our sterner moods, and nothing satisfies but a certain breadth of parts, a rigidity of aspect, a dignified reserve as we search for the sublime. Nor does any loftiness of character, nor height of form display itself, but what seems natural upon the breadth, merely in fact, a necessary proportion, to avoid contempt and ridicule. Thus perhaps it was that horizontal lines were sometimes preferred for the Italian palace; though oftener defeated in effect, by the lurking fondness which Italian artists had, for fanciful embellishment, giving occasionally an eccentric and inappropriate feature to an otherwise imposing front.

The adoption of the one style or the other results, I conceive from the spirit of the times. The artist wished to change the dull monotony of a mass, to give life and sprightly features to the building. To deck the edifice in all the fashions of elegance, sought and employed qualities in form and exterior conducive to this idea.

He knew that effective grace must depend upon the happiness of contrast, and selected the perpendicular line as the best index to variety in a front of breadth and lateral bulk. In after times the church—the Roman church was to betray the resources of its wealth;—the people were to conceive a proper notion of its splendour—the terrible and sublime were to be lost, or rather to be subdued for a little, amidst images of attraction and wonder. Hence the artist digressed, and violated symmetry, to court the spirit of the times.

Or the Ducal palace was to awe the passer by, the vassal was to shrink when near the presence of the great. Hence the judgment of the artist fed the noble's pride, by investing the edifice with all that indicated the sullenness of grandeur. The horizontal line traced itself all through the edifice, or was broken by a wing or a centre of richness and tapering forms, as if to intermix with so much oppressive dignity some picture of splendour and elegance too.

There seems no exact standard to test the merits of either grandeur or grace, yet to, a mind susceptible to and attracted by natural elegance or the pure distinctions of art, first impressions are generally most correct. Without entering however into examples which are unnecessary, if the moral of the sentiment be imbibed, and we can only trace the principle affecting the application of either to its true source, so as to assist our own ideas of correct taste and of purity in design. I shall in conclusion merely test these opposites in art, by a comparison with two opposites in nature—and would remark that as we love in woman with her laughing eye and elegance of motion, that aërial lightness, that sylphlike form, which facinates and enchants; so we expect that compactness, that breadth,—that stern solidity of air in the more dignified lord of earth. And that whereas we cede to woman with her loveliness of grace, gaiety of attire, and profusion of ornament as an increase to her charms, so we expect not to find the majesty of man masked by a whimsical dress, or cloaked by a frivolous garb. Presuming at the same time that the coldness of our fancy may lessen the contrast, and account for our giving the swellings and undulations of grace less prominence than accorded with the fire,—the energy of the ardent Italian.

Whether we transport ourselves to Vicenza and see the edifices built or restored by Palladio, or follow our own great genius of the same school Inigo Jones, into the harmonious distributions of the flat and void of the sombre and light—we see a felicity in outline, a play in effect, in which ancient beauty is reproduced and revived in combinations unknown to antiquity. This beautiful harmony seems to me the effect of lines. In the great front of the design for the Whitehall Palace, where the façade is long, we see with what consummate skill in the combination of lines, Inigo Jones pleases the eye, to a length of 1151 feet. How in the centre, column rears itself above column. How the whole centre itself is elevated—what a noble attitude it has! how rich and yet how symmetrical! Contrasted against this front of elegance comes a void where naked simplicity reigns—where little or no ornament appears—where little of what is tapering is seen—and the eye which seemed to soar up the rich and elegant columns of the centre, now wanders along the broad gloomy silent mass which intervenes.

This you see is depressed—is lower than the centre—the idea of breadth is at once visible, and the contrast with the lofty centre is apparent—and thus the effect is virtually speaking one of lines. This idea of harmonious distribution is visible in the centre itself. There to give importance to that part in so long a façade, the length of it must necessarily be great, and to remedy this Inigo Jones introduces two towers, the relief of which and their tapering appearance is very striking and effective.

As you progress along the front you catch once more the lofty wing, the columns, their statues, and the frequency of lofty lines is again seen, and your eye wanders as it were between dullness and life. This peculiarity—this attention to the varied employment of lines is peculiar to others as also to Palladio, and to be seen in his Palazzo del Capitanio and other buildings at Vicenza.

The introduction of columns in a long continuous edifice seemed not only to give the idea of support but to create variety.

Assuming this, it is somewhat singular to compare any Grecian temple with any mansion erected by Inigo Jones—or any palace erected by Palladio. We see at once by what a different method the Grecian artist produced variety in his edifice. The Greek was all simplicity—his outline was distinct, symmetrical, unconfused, and shadowless, except the portico. And variety instead of being beheld in the body and bulk of the temple, is seen rather rambling in the cornice, whilst reliefs are visible in the mouldings of the architrave, and the figures of the frieze.

To analyze this subject more closely, however, it becomes necessary to class the peculiarities of the perpendicular and horizontal lines according to time, and as seen in the various countries of architectural renown.

The descent from the classical originals in art was by a comparison with Grecian art, where symmetry ruled design to introduce extremes. And though we see effective compositions in Italy and elsewhere, we perceive that the bent of innovation was to introduce the perpendicular—only slightly seen at first—with the tendency to give altitude, appearing but faintly, gradually, and then only in a part of the edifice, undiffused.

The tower or some part en masse reared itself square, and without pilasters or columns at first even solid itself in plan, but this very contrast to the other part showed the perpendicular in its infancy. Until as the debased Roman architecture of the lower empire which forms the foundation of the Saxon, Norman, and Lombard school became successively improved in England and the north of Europe, the perpendicular found its way into those beautiful modifications, termed Gothic—and finally in the religious edifice became invested with a charm to an Englishman's fancy. For up these columns in the cathedral the eye wanders for repose, but finds itself lost in the intricate beauties of the roof, and rambling amidst the strange and the wonderful, as amidst types of the vast and incomprehensible creator.

To trace the first change from the severe to the elegant, from the breadth of dignity to the delicacy of after times. We find before the invasion of Greece by Xerxes, the Doric was the only order known. Pericles and Cimon, however, on the rebuilding of Athens, by the introduction of the Ionic order from Asia into Attica, invested the ancient massive simplicity with something of the lightness and elegance of grace. The Corinthian soon after invented, introduced more softened beauty into the taperings of elegance. The edifice before this indebted to Doric proportions for its effect, becomes now more lofty and chastely beautiful without violation to the simplicity of the whole. And this change is of great importance, when we consider in a Grecian temple that the circular of the column is in itself a relief, that the peculiarity in change is that although the result is elegance itself, as a whole the principles of the change are very slight.

Turning from Greece to other states of importance, who for convenience snatch their ideas from the polished and the civilized. The Roman appears crude at first in his attempts, alive to the beauty of Grecian proportion, but fashioning a style therefrom peculiarly his own. Unpossessed of the coolness of the Grecian, we see his ideas extending, the principles of his composition different. Unsatisfied with the novelties of ornament and recesses, he must pierce the sky—and we find the Pantheon in its dome, the bursting as it were of variety, as a grand feature (and this the result of altitude) from the cradle of ideal taste. We see here the great father of lofty turrets, tapering domes, campaniles and minarets, which with the declining power and fading grandeur of Rome became so welcome to the Italian artist.

The removal of the seat of empire to Constantinople accelerated the change—St. Sophia and its minarets betray it—and at length variety became too important. That which appears a foil to the Grecian edifice appears no longer such in the Italian. The old relics of grandeur were neglected—Venice and Pisa new-born and wealthy sought their artists from Constantinople, and the old standard of Roman excellence and pure dignity became less and less visible in the Lombard barbarians. The Saracen, the Moor, the Lombard and Italian, evince so many poor attempts to turn classic symmetry into their own love of tapering forms and fanciful outline. The Ducal palace at Venice has the very corners cut away to admit a thin column—lightness is seen here where strength should appear—a fret work of shafts is the support of an impending weight, and the whole is distortion.

Palladio however seems distinct from these errors. In the Redentore church, Venice, Palladio gives a lofty elevation—the dome diminishing in contour terminates in a figure. The dome itself is winged by turrets pierced above and capped by a cone. The whole is lofty and imposing, because pettiness in ornament is unseen, and the statues are judiciously placed uncrowded, and themselves important features, but the whole is but the grandeur of the perpendicular. In the San Petronio di Bologna a change appears, with the same love of tapering forms, the same hankering after the perpendicular we lose the grandeur of parts in the horizontal breadth, the intersections of the cornices, the play of breadths, the friezes are scarcely relieved by the height of the centre, by its diminution, by its statues, or balanced by the pyramidal terminations of the wings

The descent from the purity of Palladio was evinced by a frequency of columns, but then again to have these, induced another fashion of variety. To relieve the multiplicity of columns from offence, horizontal lines were introduced; cornices traced themselves throughout and extended their fatherly protection to a host of trifling perpendiculars. In the Baptistery at Pisa we see this, and most of those cities not removed from the pale of the remains of Roman taste, displayed this confusion of lines. Proceeding in the direction of Milan, we find Lombard Gothic and orders all united. And the miscellany, as in Milan cathedral, seems to reminds us of the full grown dignity sometimes seen in a dwarf, mixed up with his littleness of parts. Removed from the relics of classic influence we find the perpendicular gaining ground, we see the edifices of northern Europe, of Normandy, &c. beautiful and their own—elegant though profuse—lovely though intricate. Turning to Sicily we find the Normans introducing a mixture of their own with the Saracenic; and the cloisters of Monreal, the Alhambra of that country, abounding in columns twisted, spiral, light, and yet singular, a mixture of perpendicular and arch—full of wild and fanciful conceptions. In Florence we find the great exactness in the horizontal. The palaces there are so many feudal residences—edifices nearly 300 feet in length, in which the stylobate runs along the whole façade where the windows are widely apart, and the very roof frowns upon you.—The subject is a curious one, it opens a wide field of information to the antiquary and artist—but to unite these two lines is the secret of expressing charms, and we love the harmonious union as we love in the broad landscape, the lofty tree, the distant mountain, or a church tower, and thus by grasping the great principle of effect in nature, we possess the most mighty wand in creating and displaying the perfections of the beau ideal.

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EXHIBITION, ROYAL ACADEMY.

ARCHITECTURE.

It is with regret we feel ourselves compelled to commence our report by stating the present exhibition to be the least interesting one for many years past; not because it contains a greater number of inferior designs, but because there are much fewer of an attractive kind than usual. Always has there been a great deal of trash, but there have generally been many designs forming redeeming points—cheering *oases* amidst the surrounding desert; whereas, this year, the latter are both more rare and less brilliant. A desert, however, will not be thought the most appropriate simile, the walls being, on this as on every other occasion, crowded and crammed from the floor to the very top of the room. Whether this system has any influence at all upon the quality of the drawings admitted—whether some are not admitted merely because they happen to fit *nicely* into vacant places, while others are turned out because they cannot be hung up without disarranging something else, or perhaps causing a few square inches of wall to be left bare, we know not; which being the case, we are bound to presume that merit obtains preference with the Academy; yet if so, what opinion are we to form of the designs which are turned out? At all events, the Academy seems to act very naturally, because, like Nature herself, it evidently abhors a vacuum—upon its walls—no matter what is hung up in order to avoid that evil.

To be more serious—we have little doubt, for our own part, that the public are deprived of seeing much that would be creditable to the profession, solely because architects are deterred from sending drawings to the Academy, being aware that the space allotted to such subjects is so utterly inadequate, that it becomes a mere chance whether they can be received, or if they are, whether they will not be put completely out of sight, as is invariably the case with a considerable proportion of those which are received. In fact, there ought not to be more than two ranges of frames hung upon each wall, on what is technically termed the line, which space, being now generally occupied by the larger and more prominent drawings, the lesser ones, which—supposing they are worth looking at at all,—ought to be hung as near the eye as possible, are placed either so much above or below it, that it is frequently barely possible to make out their subjects. Thus the catalogue may be said to be in a great measure quite delusive, promising us what appear to be interesting subjects, and when we enter the room to look for them, we find that several are scarcely to be found out, and when discovered, all that we can discern of them is, that there is something behind a glass within a frame. In many instances, perhaps, we may lose nothing by not being able to obtain a more satisfactory inspection, but there are also others in which the being prevented from doing so is highly annoying and tantalizing. An instance occurs in the present exhibition, with regard to No. 959, "View in St. Peter's at Rome, displaying the general decorative character of the interior," by J. H. Steinmetz, which appears to be one of the most tasteful and interesting drawings in the room, beautifully coloured, and treated with the feeling both of a painter and an architect. We say "appears," because it is placed so high that it is impossible to judge fairly what it is. It may, perhaps, in consequence, look to be more elaborately finished than it really is; but then it is just as likely that we now only discern the general effect, and that the beauties of detail and execution are lost; at all events, it is provoking to meet with something seemingly so very good, so disadvantageously situated, while many things, scarcely worth notice, are thrust full in view. We should say that, considering the great size of the drawing, and the familiarity of the subject, Mr. Hardwick's View of the Railway Terminus in Euston Square, might very properly have been mounted a stage higher, more particularly as another drawing of the same building was exhibited by him on a former occasion. Inordinate space, too, is occupied by No. 944, "Remains of the portico of the Lesser Temple at Baalbec," which has hardly any right to appear in the Architectural Room at all, unless it had been elevated among the oil pictures which serve as filling up stuff to hide the upper part of the walls. It is true both Hardwick and Roberts are associates, and may, so far, have the privilege of getting better places than their neighbours; yet that is but sorry satisfaction to us who go to look at the designs the catalogue promises us. No. 942 is a drawing that ought to have been hung level with the eye, whereas, for the very reason that it is small, it is actually *floored;* so that it is impossible to examine it without stooping in a most painful attitude, there being not a single chair in this room on which a person may sit down to look at any thing so placed; which, by the bye, seems to be pretty much of a piece with the other *judicious* regulations. However, any kind of accommodation, we presume, is considered good enough, both for those who send and those who go to look at architectural drawings. Surely there must be some other room or rooms on the ground floor of the building, capable of being made use of during the exhibition for works of this class; while their being thereby kept quite apart from the pictures and other drawings would, in fact, be a decided advantage in itself. If nothing better can be done, we see no reason wherefore a line of architectural drawings should not be hung up in the hall, on a screen about five feet high, before the pedestals of the statues facing the stairs. To be sure, only a very small number could be so disposed; yet even were no more than a dozen meritorious subjects so placed, where they could be distinctly examined, it would be a great improvement, and we should feel grateful for it. We made remarks to the above effect in our very first volume, and ought, therefore, perhaps, both for that reason and because we are now convinced how utterly unavailing they have been, to desist from all comments of the kind. Yet the evil itself is so scandalous, so contrary to common sense, that we must lift up our voice against it from time to time, in the hope of thereby inciting others, and the profession generally, to take some steps towards bringing about a reform, which we can only recommend. What, we ask, is the Professor of Architecture and the Architect-academicians about, that they look upon such absurd doings without interference? Do they ever look into the Architectural Room at all? Whether they do or do not, they have equally much to answer for.

Again, we ask, what is the Professor of Architecture about? for we do not see a single drawing by him. Is his office become altogether a sinecure?—he gives no lectures, he exhibits no designs; therefore let his qualifications for office be as great as they may, they are at present quite nugatory and valueless. Most assuredly he does not follow in the footsteps of Soane, who whatever his other failings might be, was certainly diligent and zealous in the discharge of his academical duties. It is no excuse at all for him to say that Mr. Cockerell has probably been prevented by his private engagements from devoting any time to Exhibition-drawings, because, as is well known, the latter are as frequently as not made by artists employed by the actual authors of architectural designs; and we have heard that Mr. C.'s own "Tribute to the Memory of Sir C. Wren" (see our first vol. p. 254), so much admired for its pictorial effect, was the work of another hand, so that his share in the drawing amounted to no more than the idea of bringing together Wren's principal buildings into a single picture. Surely the present Professor might have allowed us to see some drawings of the Libraries he is now erecting at Cambridge, and also the design which has proved the successful one in the competition for the Randolph and Taylo Institute at Oxford; some of the rivals of which are here to be found—in the catalogue at least, if they are not all to be seen where they have been stuck upon the walls.

We do not, however, find among them any drawings of the design sent in for that building by Mr. Hallman, (author of the essay on Græco-Russian architecture, which will be found at page 93 of our present volume,) although it has been described to us, by one who has seen it, as being one of very great merit and beauty, which, to say the truth, is more than we dare affirm of any of those we here notice, for they strike us as being of a very so-soish character. Whether Mr. Cockerell's will, as it certainly ought to do, hereafter satisfy us that it was deservedly preferred to Mr. Hallman's—supposing the last to possess the taste and originality ascribed to it by our informant—remains to be seen; though we strongly suspect that originality and taste are almost the very last points taken into consideration upon such occasions.

Among competition drawings are one or two for the Royal Exchange, also for St. George's Hall, at Liverpool, and we should probably have beheld some of those for the Assize Courts also, at the latter place, had they been returned in time for sending them to the Academy. Next year, however, we shall doubtless meet with some of them, but whether with that which has obtained the first premium is questionable, because Mr. Elmes has not thought proper to exhibit his design for the St. George's Hall, though it must be poor indeed if it shrinks from a comparison with Mr. O. Jones's or Mr. Alexander's. We do not like Mr. Jones' (Nos. 97 and 1046) at all: it is in a sort of Alhambra-fashion, but after such fashion as to give us what is offensive in it, without what renders it charming. Of Mr. Alexander's we can judge only of the interior of the Hall (No. 917), but if its chief merit lay here, and it was on this account that the second premium was awarded to it, we must confess, we look with trembling towards the design which bore off the first prize. We have heard that Mr. A. himself was somewhat astonished at his success, and so too are we when we look upon this specimen of his architectural invention and taste: for it is a sort of Meeting-house affair with a few showy columns forming a gallery around the upper part like those in our modern churches, and is about as original and as classical. The gaps between the columns have certainly one advantage, which is that there would be very few of those inconvenient pillars to intercept the prospect of what the newspapers style "the galaxy of matchless beauty and loveliness" that invariably graces all festive meetings where ladies are admitted to be spectators. Accordingly we have here a display of lovely bonnets and dresses perched up in the galleries, and if such display can excuse the poverty of the architectural one, gallantry we suppose ought to get the better of grumbling. No. 977, another design for the same building by Mr. Bardwell, being a perspective view of the exterior, appears to possess a good deal of merit and some originality of character; but we are compelled to speak thus dubiously as its situation prevents its being examined,—at any rate without getting a cramp in the neck.

We meet with other competition productions in Nos. 1016 and 1001, both for the Nelson Monument, viz., the latter a model of Granville's design for a cast iron column, the other Mr. Goldicutt's colossal globe—we have heard it called "Goldy's Pill"—for the centre of Trafalgar-square—and which is mystically designated in the catalogue "A Vision of the nineteenth century"—a very taking title, no doubt.

Neither of Mr. Barry's subjects (Nos. 923 and 839) have quite satisfied, or rather both have disappointed us. The front of the Unitarian Chapel lately erected at Manchester, is undoubtedly very far above the average, and is judiciously treated inasmuch as it is not made to look like a model for a large building executed upon a small scale. Yet while there is nothing to censure, neither is there any thing particularly to admire. The other design "for the additions and alterations at Highclere, the seat of the Earl of Carnarvon," shows the proposed conversion of a plain modern house into a mansion in the Elizabethan style, by the addition of turrets at the angles, and the refacing and decoration of the other parts. The circumstance of the architect's being fettered by the necessity of adhering to what is already erected, as regards the general form and the position of the windows, prevents us from considering this a specimen of what he would do if left entirely to his own ideas for such a subject; still we should have expected from him greater freedom and taste in the application of that style and its details, which he seems here to have merely copied, without attempting to infuse into them any originality, or in any degree, refine them. It is by far too strictly faithful to that style to be much to our taste; nor can we conceive what there is in the latter to recommend it to the favour it has of late obtained; for at any rate it is neither economy nor elegance: more likely is it to be the disgust of the soi-disant Grecian insipidities—bald and staring sash-windows with a few columns stuck upon before them, by way o portico, that has occasioned a relapse into the stiff, formal, and fantastical quaintness, and little frigid conceits of this semibarbarous manner, which, as it has always appeared to us, originated only in a blundering, awkward imitation of the Renaissance style on the continent. Undoubtedly there is frequently, in spite of all this, a good deal of piquant and picturesque in our examples of this class. The proper course, therefore, would be to study and select those qualities, carefully eschewing at the same time, all the coarse dross and rubbish, and the gingerbread puerilities among which they are found, but which certainly do not tend to give them any additional charm.

(To be continued.)

STONE FOR THE NEW HOUSES OF PARLIAMENT.

Sir—Several paragraphs on the subject of the stone to be used in the erection of the new Houses of Parliament having appeared in many of the London and provincial newspapers, which contain some inaccuracies and mis-statements, it may not be amiss to set the public right in a matter which, though not of great importance, has yet some national interest.

It is, of course, well known that the Commissioners appointed to visit the quarries, and to inquire into the qualities of the stone to be used in building the new Houses of Parliament, in their report addressed to the Commissioners of Her Majesty's Woods and Forests, after giving a variety of details respecting the numerous quarries they had visited, the buildings they had inspected, and the experiments which had been made to determine the physical and chemical properties of many kinds of stone, specimens of which had been obtained, conclude their report by stating that having weighed, to the best of their judgment, the evidence in favour of the various building stones which had been brought under their consideration, they felt bound to state that for durability, as instanced in Southwell Church, &c., and the results of experiments, for crystalline character, combined with a close approach to the equivalent proportions of carbonate of lime and carbonate of magnesia, for uniformity in structure, facility and economy in conversion, and for advantage of colour, the magnesian limestone or dolomite of Bolsover Moor and its neighbourhood, was, in their opinion, the most fit and proper material to be employed in the proposed new Houses of Parliament.

Bolsover Moor is an uncultivated and rocky waste in the parish of Bolsover, in Derbyshire, a short distance north of Mansfield, and is the property of Earl Bathurst; its locality, immediately on the publication of the Commissioner's report, became, of course, an object of great interest, both to the noble proprietor and to the various parties interested in procuring stone for the great national erection; but on a more extensive and particular inspection of the beds on the Moor, than the Commissioners had been able to make of them, they were found to be deficient in their capacity of furnishing blocks of a size and form, sufficient and proper for the purposes required in the proposed erections. New speculations, therefore, arose, and fresh hopes were excited amongst the many candidates for the honour of supplying the material for the buildings; it, however, was the fortune of Mr. Charles Lindley, of Mansfield, an extensive builder and quarry owner, to discover at Mansfield Woodhouse, about a mile north of Mansfield, another bed of the Bolsover Limestone, extending over a considerable tract, of a quality and character precisely similar to that of the beds on the Moor, and which promised to furnish blocks of a size and form suitable for the purposes intended. Mr. Lindley immediately, and upon speculation, at a considerable price made a purchase of the land, which was of little worth for agricultural purposes, though occupied for them, and having submitted specimens of the stone to the proper authorities, which, being tested, were found to possess the requisite qualities, and therefore proper to be used in the erection of the new Houses of Parliament. Shafts were thereupon sunk, to ascertain what the nature and extent of the beds were that the field contained, and the result of the trials being also satisfactory, workmen were immediately employed to get stone, and numerous blocks of considerable size and excellent form were speedily obtained.

The contractors for the works, with a professor of geology, visited the quarry, and there being every appearance that the field would yield a sufficient supply of material, a contract was entered into with Mr. Lindley, and he is now actively engaged in forwarding a regular supply of stone to London.

Mr. Lindley is also the proprietor of an extensive quarry of white sandstone (magnesio-calciferous sandstone), at Mansfield, which is also highly spoken of in the Commissioners' report for its appearance and durability; this quarry will yield blocks to the size of 10 tons, and the stone will work well with the Woodhouse (Bolsover) stone, a great advantage is thereby gained, because the sandstone may be used for purposes to which the limestone may not always be suited.

On reference to Table A in the report of the Commissioners, pp. 12, 13, it will be seen that the Bolsover stone is described as magnesian limestone, that its component parts are chiefly carbonate of lime and carbonate of magnesia, semi-crystalline, its colour a light yellowish brown, and its weight, in an ordinary state, per cubic foot 151lb. 11oz. Table B states that Southwell church, Nottinghamshire, (of the 10th century) is built of the magnesian limestone of Bolsover Moor, and that it is now in *perfect* condition, the mouldings and enrichments of the doorway *appearing as perfect as if just completed*, and that the choir, which is of the 12th century, and built of a stone similar to that of Mansfield (Mr. Lindley's magnesio-calciferous sandstone), is generally in good condition.

Table C, of chemical analyses, shows that the Bolsover stone is composed of silica 3·6, carbonate of lime 51·1, carbonate of magnesia 40·2, iron alumina 1·8. water and loss 3·3. Specific gravity, dry masses 2·316, particles 2·833.

All the qualities enumerated of the Bolsover stone mentioned in the report, belong to the Bolsover stone found at Woodhouse, and, like the former, the latter is remarkable for its peculiarly beautiful crystalline structure, and is, rather than otherwise, superior in its quality and appearance.

I am, Sir, your obedient servant,
Mansfield, Amicus.
20th May, 1840.

TEACHERS OF CIVIL ENGINEERING, &c.

Sir—In the last number of your Journal, you have inserted a letter from "one who has suffered," complaining of being the *dupe* of an advertisement in the newspapers headed "Offices for Surveying, Architecture, and Civil Engineering." Now, as I sometime ago advertized with that *heading*, and as I reckon your publication too respectable to deal in *anonymous slander*, you will oblige me by publishing the name of the complainant, so as I may learn whether the charge is applied to me, and if so, set myself right in the eyes of your readers.

I am, Sir, your's respectfully,
May 11th, 1840. Edward Jones,
24, *Charlotte Street*, Author of the "Principles and
Bloomsbury. Practice of Levelling."

[Mr. Jones must be aware, or ought to know, that we will not publish the names of our contributors; we consider that if there be any parties who hold out to the world that they can teach "Surveying, Architecture, and Civil Engineering," or any one branch "*in a few lessons*," they ought to be held up to the severe animadversion of the profession. This is the charge made in last month's Journal by our correspondent "one who has suffered." If Mr. Jones' advertisements do not contain such a statement, he cannot be in any way injured by the letter, but ought to be ready to support us in exposing such a practice, which exposure can only benefit, and not injure, the respectable practitioner.—Editor.]

ENCROACHMENTS OF THE SEA.

Sir—The encroachments of the sea on the coast of England having aroused public attention, a little local information may be not only interesting but useful. I have always regretted having neglected to inform you, in my former letter on this subject, that the village and church of Warden, in the Isle of Sheppy, are now covered by the sea; that since I came here in June last, a great part of Warden Point has slipped into the sea, and great part of the island, from Warden to Minster, is monthly going the same way, from underground springs and want of drainage.

In the old History of Hampshire it mentions that the people daily forded or waded across with their cattle from the Forest to "Vectis" to graze; now first rate men-of-war can sail over this place. The destruction of the western side of the island is much hastened, in consequence of the removal of stones and gravel for building and road-making.

Your obedient servant,
Sheerness Garrison, C. F. Parkinson, Capt. 73rd Reg.
May 14, 1840.

ON REBUILDING OLD CHURCHES.

Sir—I beg to make a few remarks on the impolicy, as well as the bad taste of the Ecclesiastical Commission for Building Churches, in throwing every obstacle in the way of repairing and *restoring* old churches to their former beauty and embellishment, preferring pulling them down and building in their room, a wretched little brick building, not inaptly compared, some years since, by a celebrated demagogue and enemy to the reformed religion, to a dog-kennel tied to a sentry-box. Is it doing honour to, or paying proper respect to the cause they advocate, to consider any building, however insignificant, good enough to celebrate the worship of God in? How different the feeling in the olden time! Are we not indebted to the devotion and zeal of our forefathers for the noble architectural remains of sacred edifices, whose lofty proportions, grandeur and sublimity fill the mind with awe and solemnity?—even the Heathens honoured their Gods in stately temples. A House of Parliament, a National Gallery, a Mercantile Exchange, are justly thought worthy of a noble edifice. Is it not an insult to our God, and does it not bring religion into disrespect and disrepute, when those who ought to support, and who *themselves* live in *palaces*, consider a *hovel* good enough for their *Almighty Father*?

Scrutator.

RAILWAY COMMUNICATION BETWEEN LONDON AND DUBLIN.

The Committee appointed by the Lords of the Treasury, in pursuance of an address to the Queen from the House of Commons last sessions, "that her Majesty will be pleased to give directions that an engineer or engineers may be appointed to inquire and report upon the relative merits, and the preference which ought to be given to the respective already surveyed and projected railways following:—namely, from Holyhead, *viâ* Bangor and Chester; Portdynllaen, *viâ* Caernarvon, Bangor, and Chester; Portdynllaen, *viâ* Barmouth, Bala, and Shrewsbury; Orme's Head, *viâ* Chester:" and also, "that her Majesty will be pleased to give directions that proper persons may be appointed to inquire and report upon the best means of communication by sea between Dublin and London, as connected with the said intended railways."

The Committee have selected the line recommended by Mr. George Stephenson, from Holyhead, *viâ* Bangor and Chester; it commences at the termini of the Chester and Crewe and the Chester and Birkenhead Railways at Chester, and proceeds by Bangor over the Menai Bridge to Holyhead. The line is 85 miles long, and has only 1,504 yards of tunnel; the gradients appear to be very favourable, viz.

	Miles.	Chains.
Level	41	8
5 feet per mile and under	8	0
Above 5 feet and up to 10 feet . . .	7	20
Above 10 feet and up to 15 feet . . .	20	64
16 feet per mile	7	0
19 feet per mile	0	68
	85	0

That part of the report which relates to the crossing of the Menai Bridge, we have selected and given in full.

Passage of the Menai Bridge.—The passage of the Menai Bridge is the next point of importance. It has been supposed that this would have presented an insuperable obstacle to the lines of Messrs. Stephenson and Giles; but neither of these gentlemen propose to cross the bridge with locomotive engines, the former suggesting that the railway carriages may be drawn over by horses, and the latter by a stationary engine.

There seems to be no objection to either of these plans, and the loss of time consequent upon them would probably not exceed one-quarter of an hour.

The following observations will show the sufficiency of the Menai Bridge to sustain the weight of any number of railway carriages that may be required to pass over it.

In the first place, as far as regards the mode of passage, no important difficulty can be foreseen; the only question, therefore, is one of strength.

The weight of a railway passenger-carriage, with its load, is commonly estimated at about five tons, and the length occupied by each carriage, from one connecting pin to another, may be taken at 22 feet, when several carriages are in connexion. This would give a pressure of only ·23 of a ton per lineal foot on the length of the bridge, supposing the platform to be wholly filled with such carriages.

Let us now see what weight the bridge is capable of sustaining.

It appears from the statement of Mr. Provis, who was the resident engineer during the erection of this splendid structure, that the suspended part between the pier consists

		Tons.	cwt.
Of 16 main chains, including connecting plates, screws, bolts, &c., ...	weighing	394	5
Of transverse ties....................................	——	3	16½
And of suspended rods, platform, &c.	——	245	13¾
The total weight being		643	15

The distance between the points of suspension is 579 feet 10½ inches, and the deflection 43 feet. With these data, the tension in terms of the weight may be readily computed, from the properties of the catenary curve; but it will, perhaps, be more satisfactory to derive it from the actual experiments of Mr Rhodes, who superintended the erection of the chains, and who found, practically, the tension to amount to 1·7 times the weight. This makes the tension on the supporting chains from the weight of the structure alone to amount to 1,094 tons.

Now to sustain this tension, we have a sectional area in the 16 chains of 260 square inches, which, according to Mr. Barlow's experiments, made on the chain-cable testing machine at Woolwich, are capable of sustaining 2,600 tons, without injury to the elastic force of the iron, namely, 10 tons per square inch, the ultimate strength being 25 tons per square inch.

If, then, from the absolute strength of the chains............	2,600 tons.
We deduct the strain due to the weight of the bridge	1,094
There remains a surplus of strength of......................	1,506 tons.

which is competent, therefore, to sustain a uniform load (allowing the tension to be 1·7 times the weight) of $\frac{1506}{1\cdot7}$ or 886 tons. Now if the bridge were covered with loaded railway carriages on both sides, it would only be equivalent to 265 tons, leaving still a surplus strength of 621 tons. The objections, therefore, that have been raised respecting the capability of the bridge to bear the weight of the railway carriages which it might be required to support must be considered as utterly groundless.

Mr. Stephenson proposes to establish a station at each end of the bridge, where the locomotive engines would be kept in readiness to be attached to the trains.

DESIGNS FOR THE NEW ASSIZE COURTS, LIVERPOOL.

[We have received several communications respecting the decision of the Committee, and our attention has also been drawn to a letter which appeared in the Liverpool "Albion"; it contains a general description of the successful design of Mr. Elmes, and some very appropriate remarks; we therefore give the article entire, with which we hope our correspondents will be satisfied, instead of publishing their papers, as we are so pre-occupied with matter, that we can ill spare the space for any additional remarks; however, we shall be glad to receive any other communication on the subject that may throw some light on the proceedings, in order that we may be able to make some comments on the conduct of the Committee in the next month's Journal, if found necessary.]

Sir—A plan has been pretty generally adopted, of late years, in respect of obtaining designs for public edifices. I mean that of advertising for competition drawings, and awarding one or more prizes, in the ratio of their excellence or fitness, with the implied certainty, that the bearer of the first prize should have still more substantial reward, in the superintendency of the erection of the future edifice. This, in itself, would appear, and perhaps is, the best method that, under the circumstances, could be adopted. It might be difficult to point out a better; but, Sir, a little reflection will at once show, that, however excellent this may be, in the abstract, it entirely loses that character unless it be invariably coupled with the necessary qualifications for judging, combined with excellent taste, in the *awarders* of the honours.

I have held this opinion, in common with others who have given the matter consideration, since the plan became general; but, whatever confirmation it might have then required, the award in the proposed Assize Courts has now amply confirmed. When I say, that the sub-committee, in this case, had *not* the necessary qualifications to fit them for deciding, let it not be understood, that this is done through any feeling of disappointment or personal hostility to gentlemen with some of whom I am on terms of intimacy: on the contrary, I trust I shall be able to prove the position with which I set out to the satisfaction of your readers; but I may, at once, say, that I am not an architect, the truth of which is *known to you*, therefore have not competed for the prize, consequently am not a "disappointed man" individually; but, perhaps, as one of the public, this feeling is particularly strong, and more especially so when I look around the walls of the Exhibition-room, in Postoffice-place. I am not only disappointed, Sir, with the prize-drawings there to be seen, but, with one or two exceptions, the whole. They evidence want of invention, in the first place, and want of judgment, in the second; and the two designs that combine these essentials, have, for want of judgment in the committee, been thrust aside. The majority of the designs, prizes included, evince a servile imitation of the Greek style of temple architecture, which, every day's experience teaches us, is neither fitted to our wants nor our climate. If the Greeks had had either the one or the other, they would have invented a style to have suited both; but invention with us is at once crushed, the ambitious aspirant is unceremoniously thrust out of the arena of competition, and all for want of the necessary qualifications in the awarders of patronage.

In proof of this, I shall, at once, draw your attention to the plans to which the first prize has been awarded, those of Mr. Elmes. By a narrow inspection of these, it will appear very evident the Committee were incompetent to the task allotted them.

In Mr. Elmes' perspective drawing we have a very pretty picture, exquisitely drawn, showing the Railway terminus, on the one hand, and the Assize Courts, on the other, with St. George's-hall occupying a prominent feature in the centre. With this picture, it is very obvious, the Committee have been misled. It is a most successful deception. Now for the proof. The height of St. George's-hall is about eighty-five feet. The fall of the ground, in the direction of the Courts, is twenty-seven feet. The height of the Courts at the lowest end is seventy-six feet. There should, therefore, be shown, *in the drawings*, a difference of thirty-six feet in their relative heights; but, as the Courts do not come quite to the extremity of the fall, say thirty-two feet. This difference, however, is most dexterously evaded, and leaves us to imagine the Courts and St. George's-hall will be, to a spectator in the foreground, very nearly of one height. But this is not all. In this height of seventy-six feet is included a dead wall, rising fifteen feet above the parapet of the colonnade. This wall is so much set *back* from the front that it could not be seen except at a considerable distance from the building. This, in effect, would rob it of fifteen feet more, which, added to the thirty-two feet above, gives us forty-seven feet, or, in other words, taking as much height from it, within three feet, as goes to a five-story warehouse. Let it be understood, this is in relation to St. George's-hall; but, in relation to itself, this dead wall would, practically, reduce the height of the building to sixty-two feet, making the visual difference between the Courts and St. George's-hall about fifty feet.

The perspective drawing, however, does not, in the slightest degree, convey this difference; but, in execution, this would be necessarily exhibited. Another example. The stylobate, at the southwest corner, is shown only six feet six inches high, whereas the *real* height is about thirteen feet. Moreover, windows are shown in the plans, which are omitted in the elevation; but, had they been shown, they would have spoiled the effect of the picture.

More examples of this nature might be adduced, but let us come to the interior arrangements, for, after all, these are, by far, the most important parts to be taken into consideration; but, it is very evident, Mr. Elmes calculated on the incompetency of the Committee to measure his perspective drawing and compare it with his plans. The event shows he was right. This gentleman, in the document attached to his plans, asserts, that he has complied with the printed instructions, and that every apartment contains the full number of square yards required by them. His designs, however, show he has exceeded the limits by thirty-six feet in the length of the building, but this is concealed in the plan, and is only to be detected by carefully examining the section. His Courts fall considerably short of the areas required, which were 290 square yards for the Crown Court, and 320 for the Civil Court; but the space given by Mr. Elmes is 231 yards for the former and 264½ yards for the latter, making a deficiency of 59 square yards for the one and 55½ for the other, making a total deficiency of 114 square yards out of 610; but there are two lobbies at the end of the Courts, situated behind some columns, which, if he mean to include, would leave a deficiency of 74½ square yards. From this, it is very clear, the prize was not awarded Mr. Elmes for strict adherence to instructions, although he deliberately says he has done so.

Let us now take a glance at the arrangements for the transaction of the business of the Courts. The counsel have to ascend 30 feet to their robing-rooms, and then to descend 26 feet into court in their wigs and gowns. The jury of the Crown Court have allotted them a small room, 15 feet by 10 feet, and for the Civil Court, one, 17 feet 6 inches by 9 feet 6 inches, neither of them possessing a water-closet: this last omission, no doubt, is intentional, —nothing on earth like it to bring obstinate men to a prompt decision.

The clerk of the indictments'-room is situated 30 feet *above* the ground floor. The witnesses have to ascend that height from their room, which is on the basement floor, and then to descend to the grand jury-room, situate midway, and, ultimately, to the ground floor into court. The most casual observer must, at once, perceive this to be the worst possible arrangement. The floor of the judge's bench is 6 feet 6 inches above the floor of the court, which is just twice the height it should be. The semicircular form of the courts is objectionable, from the irregular reverberation of sound proceeding from a curved surface. This has been so fully proved in other buildings similarly constructed, that various expedients have been adopted to abate the evil.

Another most important point, the lighting of the interior apartments, is really bad. He has resorted to the most clumsy and awkward expedients, and all to render darkness visible. The judges enter a vestibule totally dark; and the attorneys, barristers, &c. could not recognise one another in the corridors allotted to them. In short, the general interior arrangements are exceedingly ill contrived, being so disconnected by having four different storeys, beside the one containing the gaol arrangements, while in no case ought it to have exceeded two.

Now, Sir, for a word or two on the architectural composition of the exterior. My opinion is, that, in execution, it would prove a complete failure, and disappoint those who have been *caught* by the pictorial effect of the drawings.

The east, or principal, façade is badly arranged. The portico, contrary to the rules of architecture, and I may add a still greater authority, good taste, is denuded of the most essential element of grandeur and beauty; I mean a noble flight of steps ascending to it: instead of which it is placed on a mural stylobate, having an insignificant door stuck in its centre, as if by accident, or as if the architect had originally forgotten to provide his principal entrance.

The colonnade on either side the portico ought to have been full and uninterrupted in its whole extent: instead of which, it is divided into three parts, with pilastered blocks of masonry, each eighteen feet wide. This, in execution, would totally destroy that simple unity which ought to characterize that style of architecture the artist himself has chosen. This defect does not strike the observer in the picture, in consequence of the admirable *management* of the lights; but, in the actual structure, this would be most unsightly and offensive to good taste. Not satisfied with this violation, he has placed a line of dead wall, fifteen feet high, above the broken line of columns beneath, which, in effect, would appear to crush it, when seen from a distance. This ungraceful method of acquiring height has, I have observed, invariably destroyed the effect of other buildings where it has been resorted to. I could point out a much greater number of defects; but, at best, it is a most ungracious task: however, it is better to do so now than allow the building to be quietly erected with all its faults, and then cavil when it is too late to apply the remedy. Upon the whole, I consider the decision of the Committee to be altogether an erroneous one, because, if we put the architectural beauty out of the question, the interior arrangements will require to be entirely remodelled to adapt them to the purposes for which they are intended.

It would take too much time to point out what arrangements really should have been made; but here are a few omissions.

Mr. Elmes has no magistrates'-room, nor a room for the high-sheriff; he has also omitted the court-keepers' apartments and has not shown *cells for prisoners;* he has no room for attorneys consulting apart with a prisoner, neither has he any room where a prisoner can see his friends on obtaining a judge's order. The room he has appropriated for counsel is only twenty-six feet by seventeen feet six inches, and this is to accommodate upwards of 200 barristers, and this number, with the increasing business of the courts, is sure to be greater. In fact, the room in the present courts devoted to this purpose is much larger.

It might be asked, if so much is abridged and omitted, what has become of the space, seeing that the plans exceed the given amount? I answer, it is absorbed in large galleries, to accommodate the public attending the Crown Court. This is plausible, no doubt; but what is the practical result? That the morbid taste of that portion of the community who delight in accounts of murder, rape, and robbery will be amply gratified; while the other portion of the public attending the Civil Court have but small accommodation. Experience has sufficiently shown us, that the disgusting details of criminal courts act more by way of *precept* than example on the auditory who frequent them.

In fact, throughout the interior arrangements there is an utter absence of that knowledge of the business of courts which is indispensible to their proper arrangement. Apartments that, according to the practice of law courts, should be together are placed on different storeys, occasionally on opposite sides of the building; hence would accrue a continual travelling up and down stairs, and traversing long dark passages, when, with proper arrangement, all these annoyances might have been avoided.

I think, after this, you must agree with me, Sir, that the Committee have been misled by the beauty of Mr. Elmes's drawings, which, after all, do himself, or the artist he employed, great credit.

Seeing, through the medium of your paper, that a memorial was presented, on this subject, to Council, by two of our resident architects, Messrs. Cunningham and Holme, I have been, in consequence, induced to give their designs a more minute examination.

Their second design, I mean the one with the towers, having a magnificent portico, with a flight of steps leading up to it. This building would have been a real ornament to the town. It combines many desiderata for the promotion of architectural effect; but the towers alone are worthy of Martin. Had they been executed, they would have formed a most prominent architectural feature in the eye of strangers visiting us. I have not studied their design with a view to minute criticism. Had they received the first prize, it is highly probable they would not have been let off so easily: however, there is, at once, boldness and novelty in the conception of their plans, which bias me very much in their favour. As to the interior arrangements proposed by these gentlemen, they are very much superior to Mr. Elmes's. They seem to have forgotten nothing, but have rendered the edifice, as a whole, entirely subservient to the purpose of the courts. Yet, if I recollect aright, these gentlemen's designs were, at once, placed *hors de combat*.

In their memorial they complained that their plans had been set aside, on the alleged ground of having exceeded the limits pointed out in the instructions; while, on the other hand, the plans to which the prize *was awarded* had, in a similar manner, also very much departed from them. Notwithstanding which, they were not only allowed to retain their place among the final ten, but actually carried off the prize! Now, Sir, I cannot help thinking they had just right of complaint. But how was it met by the Committee, in the person of the Town Surveyor? At first is was denied, and *then* admitted, that is, "*if* the *porticos* were meant to be *included*"! This last, Sir, is the crowning joke of the whole. Hamlet, with the *principal* character omitted, is a fool to it. "If the porticos were meant to be included in the measurement"! Only think. Suppose your office is in want of a devil, you advertise for one, his mother applies, (if devils have mothers,) you want to know his height. The lady replies, "Four feet six." You object to this as being too small, when you are met with the *after thought*, that that is his height as far as his shoulders only; but, then, he is a *head* taller still, if you mean to include that most unimportant portion of his corpus. Of such a nature was our surveyor's answer to Messrs. Cunningham and Holme's objection. The porticos being, I need scarcely say, "the very heads and fronts" of the building.

In conclusion, Sir, I may add, that my only motive, in this letter, is, my duty as a burgess, and a love of having my visual organs gratified by beautiful architectural objects, in my walks through our flourishing good old town.

I am, an old correspondent,

One of the People.

Liverpool, May 14th.

EXTRACTS FROM THE LOG OF THE ARCHIMEDES.

First Day, April 21.—Light breezes from Northward. A.M. 7·30, left Dover Roads with H.M.S. Ariel for Calais. Archimedes rather leading. At 8·45 both vessels made sail, with light wind from S.W. At 10, Ariel one mile astern, and sail shortened. 10·23, abreast of Calais—beating Ariel by six minutes.

Second Day, April 22.—A.M. 4·10, left Calais with the Ariel—wind W.S.W. and fresher than on the preceding day; Ariel rather gaining, but on sail being set on both vessels, Archimedes came in first by five minutes. Close hauled the whole distance, and rate with sail and steam 9¾. Time of arrival in Dover Roads, 6·42 A.M. A.M. 8·30, the same morning, left Dover Roads with H.M. Packet Beaver—light winds from S.W. 9·20, one length a-head of Beaver. 9·45, three lengths a-head of Beaver—rate 9½ knots—engine making 27 strokes per minute—barometer 26 inches. 10·45, 2½ cables length a-head of Beaver. 11·30, Beaver made sail. Noon—light breezes from S.W. Beaver two-thirds of a mile astern. At 4·53 P.M. arrived in Ostend Roads, beating Beaver by four minutes.

Third Day, April 23.—Topmasts struck, and gaffs down, wind W.—A.M. 9. Followed in Beaver's wake through the Channel. At 10, going 9¼ knots—Beaver a-head one-third of a mile. 11·30, abreast of Dunkirk. At noon—moderate breezes from W.N.W.—Beaver one mile a-head—Strokes 26—rate 8¾ knots. P.M. 2, made sail—Beaver 1½ mile a-head—9½ knots. At 4h. 28m. 30s. Beaver a-breast of Dover Pier.—4h. 37m. 30s. Archimedes ditto.—Nine minutes in favour of Beaver.

Fourth Day, April 25.—A.M. 8·43, started a-breast of each other with H.M. Packets Beaver and Ariel—light breezes from E. by N.—rate 9½ knots—barometer 26 inches—strokes 27. Beaver arrived first in Calais Roads by 2 minutes 45 seconds—Ariel second, not quite three lengths a-head of Archimedes. 11·25, left Calais Roads in search of H.M.S. Swallow, with the Ostend mails. P.M. 1.28, abreast of Swallow. 2·52, abreast of Dover Pier, Swallow about two lengths astern—no sail set all this day.

Fifth Day April 27.—A.M. 6·40, started with the Britannia Steamer for Boulogne, she being half a mile a-head. At 7, on her beam—rate 9½ knots—Britannia made sail. At 7·15, made sail also—moderate breezes from the N.E.—course South—10 knots—27 strokes—barometer 26 inches. At 9h. 2m. 45s. rounded the buoy off Boulogne Pier. At 9h. 49m. Britannia passed the buoy. Difference of time 21m. 15s.—of distance about 3¾ miles. P.M. 1·52, made sail for Dover—fresh breezes from N.E.—sailing and steaming, close hauled, 9½ knots, clear full, 10 knots. At 4, the wind being fresh and dead a-head, took in sail—steaming, 8¾ knots. At 5·19, off Dover Pier—having made the passage, under the above circumstances, and *against an ebb tide*, in 3h. 27m.

Sixth Day, April 28.—On this day, Capt. Chappell, R.N., and Mr. Lloyd, Engineer from H. M. Dock Yard at Woolwich, commenced the superintendence of the trials, having been sent down specially by the Lords Commissioners of the Admiralty to report thereon. A.M. 8·45, left Dover Roads with H.M.S. Widgeon—moderate breezes, wind E. by N.—rate 8½ knots—for Dungeness light, distance 19 nautical miles. Widgeon first by 5m. 30s. In returning, against a head wind—rate, 8 and 7¾—strokes, 26 per minute. Widgeon beat by exactly 10 minutes. No sail set this day. Widgeon is the fastest of the Dover packets, her engines being of 90 horse power; her power is thus 10 horses greater than the Archimedes, while her tonnage is 80 tons less. Most of the Dover packets are of 70 horse power; they are, on an average, about 90 tons smaller, draw 4½ feet less water, and are not so broad by 5 feet. During the whole of these trials the sea has been perfectly smooth, and no opportunity has hitherto occurred of displaying the peculiar advantage of the Screw over the Paddle Wheels in a rough sea and a strong wind. Since the above was written—in a run to Calais, in a dead calm, Widgeon beat Archimedes by only 3½ minutes in going, and 4 minutes in returning:—Time in going over, 2h. 9m; returning, 2h. 11m.

The French Government Steamer, La Poste, was beaten on this occasion 25 minutes. She is about 135 tons, and her engines of 50 horse power.

On the 1st of May, the Widgeon and Archimedes started together for Calais, with a moderate breeze, both carrying sail and steaming.—Archimedes performed the distance to Calais Roads in 2h. 1m., beating Widgeon by 9 minutes. In returning to Dover, she beat the Widgeon by 5 minutes, making the distance in 1h. 53m., the fastest passage EVER made between France and England by 14 minutes.

[To render these experiments complete, the quantity of fuel consumed in each trip and by each vessel should be ascertained.—Editor.]

NEW ROYAL EXCHANGE.

The Gresham Committee met on the 7th ult., to decide on the two plans for the Royal Exchange submitted to the Committee by Mr. Cockerell, R.A., and Mr. Tite, President of the Architectural Society, and after a protracted discussion, the Committee finally determined in favour of Mr. Tite by 13 votes to 7. The building will now be proceeded with without delay. The following description of the design appeared in the daily papers:—

The design thus adopted possesses features of a very striking character, and is much approved of in the city. It will be recollected that the site of the intended building is of an irregular form. The ground westward of this site is to be cleared by the removal of the two masses of building which now stand in front of the Bank, so as to leave an uninterrupted area from the intersection of the streets in front of the Mansion-house; in this area it is intended to place the statue of the Duke of Wellington. From the nature of the ground, any form of building which should adequately occupy it, must be much wider at the east end than at the west. This irregularity is concealed, and, though not rectangular, the proposed structure is perfectly regular in the plan.

At the west end, the architect has placed a very striking portico of eight columns of the Corinthian order. The width of this portico is 90 feet, and its height to the apex of the pediment 75 feet; this is 16 feet wider and 17 feet higher than the portico of the church of St. Martin-in-the-Fields. Behind the portico is the central entrance to the Exchange, which is deeply recessed within a large arched opening, having on each side an arch of corresponding general character. When clear of the portico, the building is increased in width by pilasters and recesses, making its greatest extent at the west end 106 feet.

The south front, or that towards Cornhill, is an unbroken line of 250 feet, occupied by a range of Corinthian pilasters, the intervals between which are divided in height into two stories. The lower of these consists of a series of rusticated arches, which comprises the shops, and the entrances both to the Exchange and the offices; the upper story includes a uniform line of decorated windows for the principal floor.

The north front is generally similar to the south.

The east front is terminated at its northern and southern extremities by curved corners, each containing three rusticated arches, with windows above; and from the centre of this front rises a tower 160 feet in height, terminated by a vane, formed of the ancient grasshopper, the crest of Sir T. Gresham.

The total length of the building, including the projection of the portico, is 293 feet, and its extreme width at the east end is 175 feet.

The area for the merchants is nearly in the centre of the edifice. It is a parallelogram, 170 feet in length from east to west, by 112 feet from north to south, and is entered in the centre of each of the four side. There is a colonnade of the Doric order round this area, which leaves about one-third of the whole space open. Over the colonnade is a second order of attached Ionic columns, with arched and highly decorated windows in each intercolumniation.

With reference to the arrangements of the plan, it appears that the ground floor is principally appropriated to shops and offices, except a part of the north-east corner, which is given to Lloyd's, and the south-west, which is reserved for the Royal Exchange Assurance-office. On the one pair, or principal floor, the Subscribers'-room, Commercial-room, Reading-room, and other apartments of Lloyd's, occupy the whole of the eastern portion of the building, and about two-thirds of the northern. The Gresham Lecture-rooms, library, and other apartments, fill up the rest of the north front and part of the west. The south front, in nearly all its length, is given to the corporation of the London Assurance, which establishment is to be accommodated in the new building; and the remainder of the south and west is appropriated to the Royal Exchange Assurance.

THE METROPOLITAN WATER SUPPLY.

Table shewing the foreign matters contained in one gallon of *Thames water*, taken from different parts of the river, and of the same quantity of the water from the *Valley of the Colne*.—(See Minutes of Evidence, 1840, p. 19.)

Thames water.	Carbonate of lime.	Sulphate of lime and common salt.	Total in 1 gallon.
	Grains.	Grains.	Grains.
From near Brentford	16	3·4	19·4
From near Hammersmith	16·9	1·7	18·6
From near Chelsea	16·5	2·9	19·4
Sources of the proposed London and Westminster Water Company.			
From Otterspool (main spring)	18·8	2·5	21·3
From main stream (Valley of the Colne)	19·3	2·5	21·8
From the river Colne	18·1	3·2	21·3

Besides the above, the Thames water, as well as that from the Valley of the Colne, was found to contain a very minute portion of oxide of iron, silica, magnesia, and carbonaceous matter.

[We were not prepared to find that the water from the Otterspool spring, flowing through chalk, contained such a minute quantity of carbonate of lime as 2 grains in 70,000 grains, (the weight of a gallon of water), more than water of the river Thames. To us this appears to be a very satisfactory result in favour of the proposed new Company.—Editor.]

SUSPENSION BRIDGES.

WITH AN ENGRAVING, PLATE X.

Lord Western's Letter to Lord Melbourne, descriptive of a Suspension Bridge built across the Avon, at Bath, by Mr. Dredge, *a resident of that city, upon an entirely novel principle.*

My dear Lord,—Having heard that Government is about to expend a further sum of money on the reparation of the Menai Bridge, which is said to be in a perilous state, I cannot refrain from entreating your attention to the vast improvement that has been made in the construction of suspension bridges by Mr. Dredge, of Bath. During a recent residence of two months in that city, I have had an opportunity of seeing often the bridge that has been built by him across the Avon; it is a beautiful structure, and at once commands admiration of its beauty and confidence, in its stability; I have communicated with him frequently about it, and altogether the consequence has been so strong an impression upon my mind of the vast and immeasurable superiority of the principle on which it is built over anything that has hitherto been attempted, that I have been led into this somewhat extraordinary intrusion upon your Lordship on a matter with which I may be, I own, justly considered to have no very intimate or scientific acquaintance; such however is the simplicity of the work, that I will not hesitate to attempt some account and explanation of it, in the hope of drawing your attention in the first instance, which, if I accomplish, you will be led, I think, to give it a closer examination, which will produce eventually as strong a conviction in its favour on your mind as it has produced upon mine.

Mr. Dredge's statements of the superiority of the power of his system over the established plan of structure certainly at first astonished me; he has indeed proved by trials, in the presence of very many persons, a superiority of strength to the extent of at least 150 per cent. These were made upon small models of bridges formed severally on the present and on his new principles, each out of the same quantity of iron, but he carries his calculations of the accumulating power derivable from size and extent over and above the 150 per cent. shown upon the small models to such a degree, that I will not venture to state it; but if he should be called upon, in the way I trust sooner or later he will be, to exhibit his system before your Lordship and the public, he is confident he can mathematically and practically establish any of the statements he may make, and I have little doubt he will be found to be correct. He insists on the possibility of reconstructing the iron work of the Menai-bridge at a less sum than the superfluous iron would sell for, so much less is requisite than was there used, and he pledges himself to the power of the bridge, if the irons are altogether altered and reconstructed on his principle to be capable of supporting on transit 1,000 tons. The Menai-bridge is believed to have cost near 150,000*l*., and to have consumed in its construction above 2,000 tons of iron, and to be declared only capable of sustaining 733 tons on transit. Before I submit to your Lordship a detail of some practical experiments Mr. Dredge has made justificatory of the declarations he thus ventures to put forth, I will endeavour to give some explanation, imperfect though I am sensible it must be, of the fundamental principle upon which his mighty fabric is erected; I must give it merely as it has struck my unlearned common sense, and which it has, from its simplicity, with a force so irresistible that it makes me believe I fully understand it; in aid of my endeavour I have given a few drawings on an annexed sheet. I conceive the grand foundation may be said to be the rendering the chains strongest and indeed very much the strongest at the base, tapering them by regular degrees to the centre, where they come at last, in fact, to a cipher, from the cipher commence therefore their size, weight, and strength, which regularly increase by degrees quite up to its base, which base you know in a suspension bridge is the towers of masonry on which the chains are hung; in truth, it is the application of that principle horizontally which is so obviously necessary in all perpendicular erections, of superior size and strength at the base, and tapering away to a cipher on its ultimate summit; as for example the obelisk, the pyramid, the church spire, and which principle he shows to be as effective horizontally applied as it is in the perpendicular; indeed, it may be said to be far more effective, as it has to support in so difficult a position, comparatively with the perpendicular, its own intrinsic weight, and a heavy transit load besides. The manner in which the chains of his bridge are formed to render them stronger at the base is shown in plate, Fig. 2; and Fig. 4 is a section of one of the main chain of the Menai-bridge; these are the same size throughout, creating thereby an enormous intrinsic and superfluous weight, exceeding that which it has to sustain on transit, and this it is which constitutes the grand vice of the present system, and which sooner or later Mr. Dredge's must supersede. Mr. Dredge's bridge may be well imagined by supposing a church spire laid horizontally, and met by another of equal dimensions at the point, as represented at Fig. 8.

There is another figure by which the principle may be more clearly shown; it is the bracket; two brackets meeting at their extreme points give a very satisfactory idea of it, as in plate, Fig. 9. Every body knows that the bracket tapering from its base will bear horizontally a great weight, but if it was the same size from the base to its extremity, though it might continue to be called a bracket, it would hardly sustain itself if it was any considerable length.* I have to remark now upon another most important peculiarity in Mr. Dredge's bridge, and that is the diagonal direction of the road suspending rods, instead of perpendicular, and forming, therefore, as it unquestionably does, a powerful contributary effect to the support of the whole, and this is also most easily capable of direct practical proof. There is still a further point of difference and advantage in Mr. Dredge's bridge, which appears to me to be equally simple and as proveable, and which also essentially contributes to increase its aggregate power and security—that is, its horizontal action or pressure, which is also made obvious by a simple and familiar figure representing one half of a bridge: suppose a straight rod of any given length, fasten a cord at one end of it, and thence to the top of a wall, place the other end to that at which the cord or chain is fastened against the wall, at such a distance below the top of the wall as will render the position of the rod horizontal, and it must be plainly seen that the rod is supported as well by its compression against the wall at one end, as by its cord of suspension at the other, see Fig. 10. Thus every component part of the structure is brought harmoniously to work and in perfect unity of action towards the grand object. I will now advert again to the Menai-bridge, and show further in essential points the difference between that and indeed most other suspension bridges, and Mr. Dredge's. The actual intrinsic strain at the centre of the Menai-bridge according to "*Drewry*," page 167, amounts to 1,878 tons, and at each extremity 1,943 tons. This vast intrinsic weight operates its own destruction, increasing its self-destructive power as it increases in length; thus it becomes vibratory, and upon a gale of wind blowing upon its broadside, it has a swing or pendulous motion; this I have felt myself in passing it, the wind blowing strong at the time.

On the other hand, as I have observed before, upon Mr. Dredge's principle, the strain and weight only commence at the centre, increasing as the strength of the bridge increases up to the base, and of course its ability to sustain it; this difference between these two systems may be readily imagined. By supposing a ton of iron formed into a bar of equal dimensions from one end to the other, as is shown in Fig. 7, and fixed into a wall, it will hardly support itself, still less any additional load; if extended to any considerable length it will not support itself; on the other hand, make the same weight of iron into a taper form, as in Fig. 6, and it will support its own weight to any extent, and a heavy extrinsic weight in addition; but further than this, if the parallel equal-sized bar is cut away by one-half, (see dotted line in Fig. 7,) it will then support itself and an extrinsic weight in addition. The reason is obvious; it has discharged itself of that which was altogether superfluous and therefore noxious in the extreme, being wholly destructive of power to carry any extrinsic weight. In this figure is a singularly accurate exemplification of the vice of the Menai-bridge, and others built upon the same principle, and the obvious good sense of Mr. Dredge's. Thus his genius has led him, by the simplicity and perspicuity of his conceptions, to effect a discovery which, I firmly believe, will turn out of great national importance, the recognition of which by the country will, I am sure, be felt by him as the highest possible reward. Having thus endeavoured to show the simple principle on which Mr. Dredge's system is founded, I proceed to give you some account of some experiments he has made practically substantiating the truth of it, prefacing them, however, with a brief description of the expense and particulars of the Victoria bridge across the Avon, built in 1836, and which has proved itself equal to its inventor's most sanguine expectations; its cost was 1,650*l*., its span is 150 feet, and only 21 tons of iron were consumed in its construction, which, at 20*l*. per ton, is only 420*l*.; the great expense, therefore, was on the masonry and the timbers supporting the platfr/2

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* It may be remarked that there is not a strict similarity between the common bracket and the bridge, inasmuch as the platform or horizontal line is, in the former, above and in the latter, below; there is, however, no real difference. The power of the bracket is compounded of suspension and compression, that is, suspension from the fulcrum, and compression against the fulcrum. In the case of the common bracket, the horizontal line which is uppermost, being fixed or fastened securely to the fulcrum, performs the suspension part of the work, the arch or diagonal line below the compression, attaching itself to the fulcrum without fastening; the case of the bridge is, however, only so far different, that the arched line does the suspension part, and the horizontal the compression.

of wire, their spans were 4 ft. 6 in., their deflections 6 inches, and their platforms were 2 feet. The parallel chain model (old system) broke down on putting six sacks of beans on its platform, weighing about 13 cwt.; the taper chain model (new system) bore the six sacks of beans, seven sacks of malt, weighing 10 cwt., 2 cwt. of iron, and 11 men at the same time, all of which did not break it down. In Bristol, Jan. 6, 1838, before Messrs. Protheroe, Guppy, and others, two other models of equal materials and dimensions were tried. The parallel chain model bore 1,565 lb.; the taper model bore 3,681 lb. Again, in Bristol, January 10, 1838, more trials were made before Messrs. Acraman, Daniels, Hillhouse, and many others of the first merchants of Bristol, Dr. Waldron, and many others of Bath, with models of equal material; the parallel chains bore 1,456 lb.; the taper chains bore 3,696 lb. Another trial before the same party on the same day was made with models constructed by Mr. Cross, of Bristol, unknown to Mr. Dredge, in order to prove that all was fair in the former trials; the result was, the parallel chains bore 2,632 lb., and the taper chains bore 6,849 lb. Each model broke on adding more weight, and the wire throughout on the taper principle was reduced one size by the experiments.

Now, my Lord, all I request is, in the event of further repairs or improvements being about to be undertaken of the Menai bridge, that you will allow Mr. Dredge to exhibit some similar experiments before your lordship or the Treasury, or before the Bridge Commissioners, and in the presence of any of the most eminent engineers you may choose to summon. Finally, my lord, Mr. Dredge declares that such is his thorough conviction of the truth of his theory, and its facility of execution, that he would gladly undertake, at his own expense and risk, *the whole of the iron work*, if he should be allowed to reconstruct it, which he believes he could do, the bridge standing all the time, and that it should be competent to sustain 1000 tons on transit; the superfluous iron of the present bridge he is pretty confident would pay him, and give a balance in favour of Government.

Questions may, after all, fairly be put to me to learn why, with all these advantages of Mr. Dredge's system, exhibited with so much apparent fairness, has not his principle been at once generally acted upon? Why has he not been called upon in many cases to execute what he thus promises? Why, if he can build the proposed Clifton bridge, as he says he could, for one-third or less than Mr. Brunel's estimate, is he not called upon to do so? One good reason is obvious —a prudent caution on the part of the public disinclines them to overthrow long-established systems, and to oppose or even question the judgment of long known and respected authorities; this feeling operates very naturally and happily in philosophy as well as in politics; but it should not in either be carried to the extent of checking the progress of improvement by well-considered means; too great a tenacity for old systems may exist in the minds of many persons, though their motives may be good and their minds not illiberal; Mr. Dredge's principle of suspension bridge building completely overthrows the theory and practice of a Telford, a Brunel, whose experience and talents we are bound highly to respect, and to whose genius I readily offer the humble tribute of my admiration; can we then be surprised that the public should evince some fear, and some reluctance, hastily to adopt Mr. Dredge's novel principle or theory, in substitution of that which has been so long acted upon? They ought, therefore to pause, they ought to inquire if there are any persons about to direct the construction of other suspension bridges; it is a duty they owe to those for whom they may be acting, to examine fully into the merits of a novel system which *promises fairly* such advantages, before they determine to persist in the further adoption of the present, of the correctness of which the state of the Menai bridge, and the vast expenditure it occasions, may well create a doubt, independent of the obviously faulty principles on which it is, I think, clearly shown to be constructed. No human being was ever exempt from error, and Messrs. Telford, Brunel, and others, must not be considered to be infallible. I have only to add, my dear lord, that in making this address to you, I have no other motive than the desire of assisting to bring forward genius, and secure for the country the benefit of a most valuable discovery and work of art, which appears to me, for want of form or road, which are still of insufficient dimensions and strength, but which, of course, are quite unconnected with the principle on which the bridge is built; the chains are under 10 tons, and are equal to sustain 500 tons on transit. In November he began putting the chains of this bridge together, and in the following month it was opened for general use; its road is stoned like common roads. In further proof of the correctness of this system, tests have been made before various parties at various times, viz., at Bath, January 2, 1838, before Messrs. Worsams from London, Ball of Cambridge, and others of Bath, with models whose lengths, deflections, and weight were equal, the chains of each model between the fulcrums were only 9 oz.

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that encouragement which I think it merits, to be in danger, like very many others, of being lost sight of altogether.

I have the honour to be, my dear lord,
Your faithful and obedient servant,
To the Viscount Melbourne. WESTERN.

P.S. Your lordship will of course understand that I entertain no idea of expecting or asking anything more of your lordship, than a reference of Mr. Dredge to the proper departments, with a recommendation to give his plan of improvement due attention and consideration, should Government be under the necessity of engaging in further expense upon the Menai bridge.

[At the Adelaide Gallery on the 19th ultimo, Mr. Dredge explained the principles of his patent suspension chain bridge, and performed some experiments in the presence of several gentlemen to show the relative merit of his suspension chain in comparison with one on the ordinary construction. He had made two models of suspension bridges, each 5 feet 8½ inches long, and with chains of 8½ inches deflection— the first experiment was with a model constructed with two chains on the ordinary principle, each consisting of 3 wires laid parallel to each other as in fig 4, to which by the aid of vertical wires as in fig. 5, a platform of wood was suspended, this platform was loaded with 7 full grown persons, and upon the eighth getting on, it broke down. The wire chains were fractured at the point of suspension. The weight of the wire in this model was 6¼ ounces. The next experiment was with two wire chains consisting of six wires at the point of suspension, and diminishing off to one in the centre similar to fig. 2, these chains supported by suspension wires placed obliquely as shown in figs. 1 and 3, the platform which was loaded with 11 persons, without producing any fracture, until one or two of the party stamped on the platform, when it broke down, the fracture taking place at the junction of the oblique wires with the chain of suspension. The weight of the wire in this model was only 6 ounces.—EDITOR.]

REFERENCE TO THE ENGRAVING, PLATE X.

Fig. 1, a view of Victoria bridge, constructed by Mr. Dredge on his patent principle over the river Avon, at Bristol.

Fig. 2, a chain constructed on Mr. Dredge's principle.

Fig. 3, a bridge of large span similar to the Menai, constructed on Mr. Dredge's principle.

Fig. 4, one of the main chains of the Menai bridge.

Fig. 5, a view of the centre suspension of Menia bridge.

Fig. 6 to 10, diagrams to illustrate the principle of Mr. Dredge's chain.

EXHIBITIONS OF COMPETITION DRAWINGS.

SIR—In my former letter it did not occur to me to make a suggestion that might possibly be deemed worth consideration, which is, that in exhibitions of competition drawings—supposing they do not take place until after the decision has been made, there should be no disclosure as to which among them have obtained premiums, at least not until a given time has elapsed. The advantages that would attend such a regulation are, I conceive, tolerably obvious, because, not knowing which are the rejected and which the approved designs, the public would then give their attention to all, at any rate to such as appeared to them of most mark and likelihood, without prepossession or bias, whereas, when it is known which are the premiumed drawings, those naturally engross attention, and the rest are looked upon, by the majority of visitors at least, as the doomed, consequently not entitled to admiration. Public opinion would thus be left free from prejudice, prepossession, and prejudgment; consequently there would be a stimulus to diligent examination and scrutiny which does not now exist.

How far such a plan would prove a convenient one for the judges themselves, is a different matter. Probably it would subject them to a severe ordeal, and place them in an awkward situation; for it is my opinion that had not the fact been made known beforehand, no one would ever have suspected that Mr. Railton's and Mr. Grellier's designs obtained the first premium, the one for the Nelson Monument, the other for the Royal Exchange.

However, so far from being made any objection to the course here recommended, that becomes an additional argument in favour of it, because those with whom the power of awarding the premiums rest, would feel a much greater degree of responsibility than they now do, and would accordingly exercise greater caution and scrupulousness, lest they should find themselves in a most disagreeable minority. Those who would not care to submit their judgment to such hazardous ordeal, are but ill qualified for the important office they assume.

I remain, &c.,
Q.

MOVING BEACHES.

"I acknowledge no authority but that of observation."—*Linn.*

The attention of scientific and practical men has for many years been directed to the action of the sea, and tides which give motion to the shingle, and other matter composing the beaches of our island, and this important affair has been a subject of much speculative opinion, but it appears not hitherto to have received that systematic investigation which is essential. Indeed the contrariety of opinion so often expressed on this subject, seems to indicate an absence of a satisfactory mode of inquiry to obtain a practical and safe deduction.

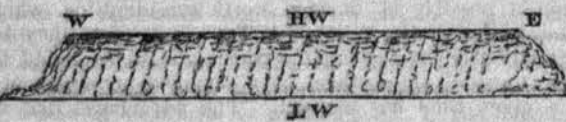
The coast of Kent and Sussex seems to have attracted attention to the subject of the commonly called *travelling beach*, under an erroneous presumption that such occurrences are peculiar to those shores, but experience, the result of practical observation, demonstrates that where nature is placed under similar circumstances, as to her formation, and the operations of the wind, sea, and tides, there she is immutable in her results, and therefore in all parts of the globe, the movement of the beach is the same as is observed on the Dover, or Channel shores; but in *no instance throughout the world has a beach been found to travel along the line from one point to another of a shore or coast.*

We proceed then to prove the egregious error so commonly adopted as to the *travelling* of a beach—divesting our statement of all terms that do not belong to, or which are not generally understood by nautical and other persons that take an interest in this affair.

The flood in the British channel sets in from the westward, and runs with considerable velocity in many parts to the eastward; it is during the time of this flood, with winds blowing from particular points of the compass, that *accumulation* of beach occurs.

The margin of all coasts throughout our globe having *beach forming the line of high and low water mark*, is constantly moving, so as to alter the angle considerably between the two lines. The wave falling on and moving the beach (for there is no movement of the bed of the ocean where the sea does not *break*), takes it up, and deposits it between the high and low water mark, in extraordinary tides and winds, and high seas, simultaneously, and with mathematical accuracy, along a line of beach to the extent of many miles, the largest pebble or shingle, and the greatest quantity, forming the same into a ridge or bank, in a line parallel to the high water mark (Fig. 1.); from the *commencement* of the shingle west, *to its terminus east*. A beach of sand is operated on precisely in the same way, but if the beach travelled in a right line with the coast, from west to east, than would the line of high water beach be on an inclined plane from west to east, and in time a mountain would be formed at the eastern terminus of the *beach*. (Fig.2.)

Fig. 1.



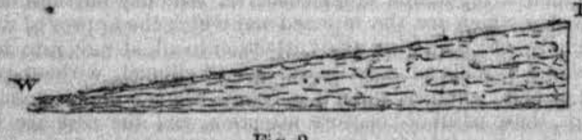
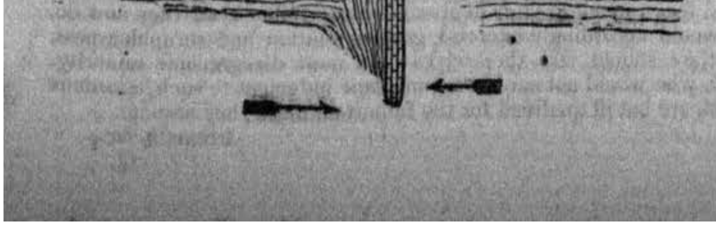


Fig. 2.

It is correctly stated that a groin or any natural projection beyond the line of coast, intercepting the tide in its passage eastward, would have its *weather*, or to speak nautically, its flood, or western side filled up in the form of a right angle, but that its east, or lee side would be without any extra accumulation, to a certain extent this is quite true; this deficiency is in proportion to the quantity left on the weather side, which but for the projection or groin would of course obtain the quantity so deposited on the west side (Fig. 3.), but at a short distance east of the groin, or on its lee side, the beach assumes its natural form, and the line continues till it meets with another similar interception. So then the only object obtained is an additional accumulation westward, less its amount eastward of the groin, and let it be remembered that this eastern continuation goes on, although the accumulation on the western side of the groin has not filled it up, to its seaward end, and therefore does not pass round it. Beachy Head, Dungeness, the south and north Foreland are all natural groins, but the Bays east of the Head to leeward, the eastern side of Dungeness, the east Bay of Dover, Deal beach, (the *highest of all* modern accumulation, notwithstanding the projection of the south Foreland as A GROIN,) Margate, Herne Bay, &c., all simultaneously accumulate, despite of those extended projections.

Fig. 3.



The fact of the angular formation of the accumulation at the groin, at once proves the direction the beach takes when thrown up by the sea. As the sea, at all *times* during the prevalence of the accumulating tide and wind, falls on the shore at an angle of 45°, so what it lifts up, it throws on in the same direction, but if the beach moved in a right line with the coast, it would fall on, and form at the groin in a like line.

The next practical fact we adduce to disprove the hypothesis of a travelling beach is, that wherever a line of shingle beach is intercepted by chalk, rock, sand, or any other material, of which such part of the coast may be composed, there no pebble or shingle exists. On the rocky shore west of Dover, in which there are many interstices, receptacles for various shell fish, there is no shingle or pebble found in any part of those rocks; if the beach at Dover, &c., came from the westward, it must pass over those rocks, and consequently in its transit some would be deposited in the holes of the rock—but it is not so.

Captain Martin of Ramsgate, in his recently published book on that harbour, states, that the beach north of Deal advances eastward at the rate of one mile in 60 years. A map of this part of the coast published 60 years ago, is before us, and *Stone End*, (meaning the end of the *shingle beach*, and the commencement of a sand and muddy shore,) is marked thereon, and although 60 years have passed away since the mark was made, *Beach End remains in statu quo*. About 90 years have expired since the commencement of Ramsgate harbour, and therefore according to this gentleman's statement, the beach in the vicinity of Sandwich Haven, during this elapsed time, has advanced towards the mouth of Ramsgate harbour, and in time would block it up, first having placed itself before the entrance of Sandwich harbour.

In a Report of the Commissioners of Ramsgate harbour, made in 1755, they stated "*that from the east there is a drift of large shingle.*" It would be well if recent assertions were sustained by proofs.

Our next fact in this controversy is, that the pebbles composing beaches differ much in quality, colour and size. Those at Dungeness, differ from those at Dover, &c., and therefore the latter cannot be supplied from the former.

Having said what we think is sufficient to expose the error, in the supposition that beach travels from one point to another, let us proceed to show the real extent of *moving beach;* we have already said that the sea takes it up, and lodges it on the shore at an angle of 45°, (the angle at which the wave falls when it does not roll in perpendicular to the shore); this inclination of the wave is aided by the flood tide, which gives the beach so lifted up, an easterly direction on the Kentish coast, inclining with the flood as it does on all other shores. On a change of wind, and with an ebb tide, the accumulating power ceases, and is succeeded by the drawback, or scattering power, and the beach recedes to its former lodgment, going off in the opposite angle or direction—and there it remains till the accumulating power again removes it. This is the extent of a *moving* beach.

A shingle beach is not carried by the drawback wave so far seaward as is a sand beach; the gravity of the latter being more than that of less the former, it is drawn often 50 yards beyond the low water mark, and there forms a bank, called by pilots, and beachmen the outer bank, over which it is with much difficulty and danger passed by boats. This is as we have said like the shingle brought up by the accumulating wind and tide, and lodged between high and low water mark, simultaneously along an entire line of coast. The shingle beach at Offordness, (formed similar to Dungeness), along the coast of Norfolk, and Suffolk, round the British Isle, and throughout the world is operated on in a like manner, so that the opinion of travelling or moving beach being peculiar to any particular coast is erroneous. Nature is, we repeat, immutable in her results, acted upon by similar causes throughout the world.

It has been asked how do you account for the increase of beach? Observation has induced us to be of an opinion that there is a progressive principle of accretion in the pebble or shingle. Quite small fine beach is sometimes in great quantities found near the low water mark, and appears to be the nucleus of the larger stone or pebble.

We come now to a question of much importance, and intimately connected with our subject, viz., what is the cause, that one convex wave rolling with impetuosity on the shore, and receding back with the like rapidity, leaves behind it a quantity of beach, so that at the end of the flood tide, as the water falls away during the ebb, a large extra accumulation of beach is found up towards the high water mark? But with a change of wind the same formed billow falling on the shore, and receding back to the ocean with the like velocity as the former, takes away with it the beach to a considerable depth, and scours away whatever is within its drawback influence. We ask for a solution of this problem, if buckets of water are thrown on a floor, each produce, as they rush up an inclined plane and fall back again like effects, taking away whatever sand or loose matter is reached by the water—not so with the impinging and receding billows—one has an accumulating, the other a scattering power.*

The subject of moving beach is, indeed, as your intelligent correspondent Nota,† remarks, *connected* with the construction of piers, and into which, as another of your correspondents observes, celebrated engineers have searched in vain, and therefore the lack of correct information on this point is one cause of the failure in improving existing, or in establishing eligible refuge harbours.

Nota has also made some judicious remarks on the subject of the accumulation of mud on the northern shore of the Severn. Whether his hypothesis be correct or not, as to the cause of this, I will not now dispute, but similar operations are in action in all bays and rivers. The deposit on the shores of the Thames is similar every flood tide, that the watermen are obliged during the receding tide, by artificial means to cause an undulation of the water, so that in its drawback course it may take away the deposit of the preceding flood, and keep the shore clean.

Your correspondent speaks of a ship's rudder having been found 10 feet below the level of the shore, while excavating the Bute Dock, Here we have another proof of the progressive accumulation on the margin of the coasts. In the bed of the river Store, in the Island of Sheppy, and in many other parts, the relics of vessels and boats, and also of anchors have been found. Instances have occurred of stranded vessels having been buried between the high and low water mark for many years, and by the effect of the drawback wave have again been uncovered.

Much valuable land has been redeemed from the river Humber by a deposit of mud, a large portion of the rich marsh soil in the vicinity of rivers is an alluvial deposition, and a great part of Holland is the result of this principle in nature, aided by artficial means.

The great geologist Baron Cuvier stated that which we by observation discover to be the fact, viz., that all bays have a disposition to fill up, the water passing along a coast with velocity is charged with matter in suspension, this water or tide falls on the shore inertly, and deposits the mud or that with which it may be charged, so that there is a progressive action proceeding onward, which in time forms the bay into a straight line, and this is often accelerated by the washing down of each point of the crescent which forms the bay. I with deference to your correspondent, we are of opinion that he has confined his exposition of this matter to a local cause, rather then to a general principle.

There is, we humbly submit, a prevalent error in the remarks of your correspondent, who follows Nota, and it is one of those errors which it is most difficult to grapple with, it pervades the minds of pilots, beachmen, &c., viz., the deducing a coincidence from a coexistence, it is of the character of the old tale in endeavouring to connect Tinterton Church with the Goodwin Sand. I do not apply this to him, many of his deductions are correct, but I am sceptical as to the fall of Chalk Cliff west of Dover, being the cause of the diminution of the bar or beach at Dover harbour, if he had watched the effect of the late prevalent winds, he would have seen that this diminishing power was at work many miles east and west of him, from the *North Foreland to the Isle of Wight*, &c., and on the northern and eastern shores; so that he appears to form his opinion "from partial, and not from general laws."

This gentleman asks for a solution of the problem, *i. e.* "the cause of the regular high marks successively following each other on Lydd Beach?" (as it does over other parts of Dungeness), we answer, the same cause that has produced similar effects on other coasts—here again we revert to general laws. It is admitted that each ridge indicates a former high water mark, and that the present high water mark is considerably seaward of those ridges, the inference necessarily is that either the tide does not flow so high as it formerly did, or that the beach has been raised by some *unusual* flow of the tide, the latter is the solution, and we observe like effects on other shores, &c. Deal Beach from a distance, southward of Walmer, and north of Sandown Castle, including the site on which *Beach Street* at Deal is built, is the largest accumulation of beach we know of, caused by one of those tides we have spoken of, since which no such rise of the tide has occurred, but if we pass further inland in this locality, we find ridges of shingle similar to those at Dungeness. The same effects have been produced on the coasts of Norfolk, and Suffolk, traced out by the like existing proofs.

The site on which stands the town of Great Yarmouth, gives a demonstrative proof of the accuracy of our deductions, it was once a sand in the ocean, called by the Romans, Cerdic sand.

It is a very natural consequence that matter thrown on the shore by an extraordinary rise of the waters of the ocean, should increase its level above the latter, inasmuch as the annually decomposed vegetable matter, (its own produce), &c., tends to cause such an effect. Buildings constructed thereon have after many years been again taken away by the raging wave.

We have only to remark on the subject of the sea advancing most prejudicial on one part of the coast, taking away fields of corn, &c., and receding from another part, that we see similar effects in various parts of the world, and have an opinion on the cause of this, but it might be deemed problematical for the present, therefore we withhold it.

In conclusion, we remark that our globe is progressively under transitions, and while these are going on, we detect the change of substance, but not the principle of destruction.

> "See dying vegetables life sustain,
> See life decaying vegetates again."

Having lengthened this letter much beyond our intention, we conclude, earnestly and with deference to the opinion of others, by inviting investigtion on the important subject here discussed, and to give it their serious and candid attention, and let it not be forgotten that subjects susceptible of mathematical demonstration are within the solution of educated engineers, but those relating to the change of form of coasts, to the impinging of the wave, effect of currents and tides, and the disemboguing waters are understood only by practical observation, the result of much attention, and long and extensive experience on various coasts.

Henry Barrett.

May 11, 1840.

CATHOLIC CHAPELS—MR. PUGIN—THE INSTITUTE.

Sir—In the Argus newspaper of May 10th, it is stated that "one architect alone, Mr. Pugin, is at present engaged in the erection of no less (fewer) than seventeen Catholic chapels in England." If such be really the case, no wonder that Mr Pugin should be so impressed with the excellence of the Romish, for it seems to have operated almost a miracle in his favour. It would, however, have been more satisfactory, had we been also informed at what places those chapels are, whereas, not one of the seventeen is mentioned by name. Perhaps some of your correspondents will be able to point out such of them as have come to their knowledge. As for Mr. Pugin himself, he seems to be quite satisfied with the notoriety he has earned for himself with his professional brethren, and accordingly does not care to communicate either through your Journal or any other medium, the slightest intelligence of what he has lately done or is actually doing. There never is a single architectural drawing of any kind by him in the exhibitions of the Royal Academy, consequently, if he sends any there at all, they are invariably among the rejected.

Pray, does not the Institute keep some kind of record of all the public works and buildings going on through the kingdom? If it does, you will have little difficulty in ascertaining the correctness of the statement in the Argus; if, on the contrary, it does not keep such historical record, it leaves that undone which would, in time, become a series of valuable documents. To say the truth, it appears to me, and I believe to many others also, that the Institute stands in need of a little filipping to rouse them to some exertion *pro bono publico*. How happens it that only one volume of its Transactions has yet made its appearance? why is it that it has not boldly taken up the subject of competition and its notorious abuses, undeterred by the various difficulties attending any attempt at reform? and why has it not rescued the profession from the Black Hole at the Royal Academy, by establishing an annual architectural exhibition upon a proper and becoming footing? These are questions which, I dare say, you cannot answer personally, but can any one else.

I remain, &c.,

P. S.

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[*] The cause appears obvious to the writer.

[†] See Journal for May, 1840.

ON THE CONSTRUCTION OF OBLIQUE ARCHES.

Sir—In your number for April, p. 116, I observe some observations upon my work on Oblique Bridges, made by an anonymous writer under the signature B. H. B., to which I feel disposed to make a reply, requesting the favour of a place for it in your valuable periodical.

In the first place I wish to premise that I think no author is under the necessity of replying to the criticisms of an anonymous writer, and that it would be more courteous if the writer of a paper professing to be of a scientific character were to put it forth with his name.

B. H. B. in alluding to myself says as follows: "he observes the lines of the courses of the intrados should be made perpendicular to a line drawn between the extremities of the face of the arch, without ever giving any reason for it, or making any remark on the subject farther than that it should be so."

It is quite true that I did not assign a reason for this construction; because it is obviously in order that all the courses may be as nearly as possible at right angles to both faces of the arch, and at the same time parallel to each other. The greatest variation from the rectangular intersection is at the middle of the development, or at the crown of the arch: and at this point where the course is nearly horizontal the variation is of no practical importance or objection: and it may be shewn that it differs from a right angle by an angle whose tangent $= \left(1-\frac{c}{a}\right) \cot\theta$.

The two methods suggested, proposed, or recommended by B. H. B. to be substituted for the above, are most extraordinary. His second method which he prefers, may be described as a recommendation to build an oblique bridge by *commencing with horizontal courses*, and "summering" them (in workman's phraseology) as the work rises upon the centre. In this way the unscientific ugly old canal bridges were built half a century back. B. H. B. concludes his short dissertation on his proposed improvement in the following words:

"The advantages to be derived from this are, first, that this angle being less than that commonly employed, there will be less tendency to slip; and secondly, that being more nearly perpendicular to the face of the arch, there is consequently more stability."

Every thing herein contained is merely assumed; and most certainly I venture to say that the stability of the oblique arch does not depend upon the courses being laid at right angles to the line *bounding the development*: it is scarcely possible to conceive any thing more rotten than such a construction would prove.

B. H. B. next says, "I am astonished at the serious errors into which Mr. Buck has fallen in his last chapter, which is devoted to *further investigation*, but which had better have been omitted altogether. In attempting to determine at what altitute above the level of the axis of the cylinder the thrust of the arch will be perpendicular to the bed of the voussoir, he gives a formula which produces the strange result that the smaller the arch-stone, the lower will be the said altitude, that is to say, the more secure will be the arch, and also that it will be able to be built at a more acute angle. Another still more strange phenomenon, the result of this formula, is that the greater the skew of the bridge, the less of the arch will have to be supported by iron dowels and bolts: thus an arch built at an angle of 25° will require no assistance from dowels, an arch built at 55° will require to be secured by dowels to a height of 25° above the springing." I will carry the quotation no further, because I shall now proceed to show that "these errors" are attributable to B. H. B. and not to the formula. For the information of those who have not read the work referred to, I will here supply the general formula which I gave for the value of sin τ, as follows:

$$\text{Sin}\,\tau = \sqrt{\left\{\left(1-\frac{r+e}{r}\cos^2\theta\right)+\left(\frac{a}{2c}\sin^2\theta\right)^2\right\}}-\frac{a}{2c}\sin^2\theta$$

In this expression θ is the angle of obliquity, r is the radius of the cylinder, c is the thickness of the arch, and τ is the angle of elevation of the point sought above the axis of the cylinder.

Now if B. H. B. will look attentively at this expression, he will see that its meaning is precisely the reverse of that which he has stated; for instance, "the smaller the arch stone" (or e is taken) the greater will be the value of sin τ; and this is because e appears only in the *negative* part of the expression. Again, the *greater* the value of e or the thickness of the arch stone, the greater will be the negative part of the expression, and consequently the *smaller* the value of sin τ: and the lower the point sought at which the thrust of the arch is parallel to its face. And consistently with this, "the greater the skew of the bridge," the greater is the value of $\cos^2\theta$ which is also found only in the *negative* part of the expression, and consequently the smaller will be the value of sin τ, and "the less of the arch will have to be supported by iron dowels and bolts." This result of the formula is said to be a "strange phenomenon." I have no doubt it is very startling to the reader, as I know it to be to every practical man at first sight, but it is nevertheless true as I have satisfactorily determined experimentally. I have constructed a model of a portion of an arch at an angle of 25°, which is semicircular on the direct section: this arch stands and keeps its form well without dowels, (although it is but a narrow strip), whereas one made to the same scale at an angle of 45° will not stand at all.

B. H. B. proceeds to say, "the whole of these errors arise from having given the expression $\frac{\operatorname{cosec}\theta\cos\tau}{\frac{1}{2}\pi}$ (nearly at the bottom of page 37) instead of $\frac{\cot\theta\cos\tau}{\frac{1}{2}\pi} \div$ cosine $(\theta+\phi)$ where ϕ is such an angle that its tangent $=\frac{\cot\theta\sin\tau}{\frac{1}{2}\pi}$. This must be evident to any one who considers that the courses alter their angle with regard to the face of the arch, which Mr. Buck has not taken into consideration."

Here I most readily admit that I had omitted to take into consideration the variable angle at which the courses intersect the face of the arch. I discovered this defect about two months after the publication of the work, and immediately prepared a correction for it, which is as follows. I retain my former notation and the expression for the altitude of the point C′ from which B. H. B. says the error arises, namely $\frac{\operatorname{cosec}\theta\cos\tau}{\frac{1}{2}\pi}$, but in this case I shall substitute its equivalent for the segmental formula, or, $\frac{c}{a}\operatorname{cosec}\theta\cos\tau$, because the equation thence derived is general. I shall now refer to the annexed diagrams: those numbered 28 and 29 are identical with those to be found in my work; that numbered 27 is somewhat different.

Fig. 29.

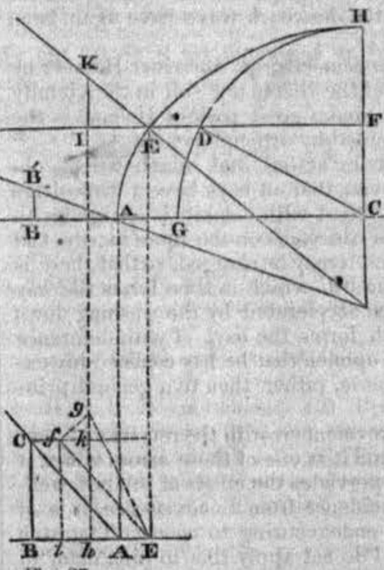
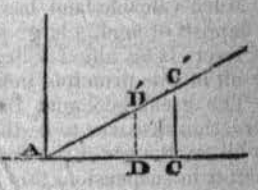


Fig. 27.

Fig. 28.



Let A B C in the annexed diagram, called fig. 27, represent the plan of the acute quoin of the arch, then when the point A may have ascended to the altitude signified by τ, let us suppose it to be perpendicularly over the point E, fig. 27. Let us also suppose A C fig. 27 which is sec θ, and CC′ fig. 28, which $=\frac{c}{a}\operatorname{cosec}\theta$ to remain constant, then C′ which is the summit of the tangent CC′, fig. 28, will not be perpendicularly over the point f, fig. 27, (the extremity of E f drawn parallel to A C), but it will be at g; here $f\,g$ is the projection in plan of the tangent C C′; now draw $g\,h$ perpendicular to the face of the arch B A, and to fulfil the conditions $g\,h$ must be a horizontal line, and the distance E h, considered as radius, if multiplied by the tangent of I E K, fig. 29, must be equal to the altitude of g above E, fig. 27, or to $\frac{c}{a}\operatorname{cosec}\theta\cos\tau$. It now becomes necessary to determine an expression for the distance E h, and first E i is equal to A B by construction, therefore E h = E i − $i\,h$, or (1 − $i\,h$.)

$$fg = CC' \times \sin\tau = \frac{c}{a} \operatorname{cosec}\theta \sin\tau,$$

$$\text{and } \frac{c}{a} \operatorname{cosec}\theta \sin\tau \times \sin\theta = \frac{c}{a} \sin\tau = fk = ih$$

$$\therefore Eh = (1 - \frac{c}{a} \sin\tau)$$

$$\tan IEK = \frac{\frac{c}{a} \cdot \frac{r+e}{r} \cot^2\theta + \sin\tau}{\operatorname{cosec}\theta \cos\tau}$$

$$\therefore (1 - \frac{c}{a}\sin\tau)\left(\frac{\frac{c}{a} \cdot \frac{r+e}{r} \cot^2\theta + \sin\tau}{\operatorname{cosec}\theta \cos\tau}\right) = \text{the altitude}$$

of the tangent at h above E.

Equating these we have

$$(1 - \frac{c}{a}\sin\tau)\left(\frac{\frac{c}{a} \frac{r+e}{r} \cot^2\theta + \sin\tau}{\operatorname{cosec}\theta \cos\tau}\right) = \frac{c}{a} \operatorname{cosec}\theta \cos\tau$$

Whence we obtain

$$\sin\tau = \pm\sqrt{\left\{\left(\sec^2\theta - \frac{r+e}{r}\right) + \left(\frac{a}{2c}\tan^2\theta - \frac{c}{2a} \cdot \frac{r+e}{r}\right)^2\right\}} - \left(\frac{a}{2c}\tan^2\theta - \frac{c}{2a} \cdot \frac{r+e}{r}\right) \qquad (A)$$

The values of τ for the several cases of obliquity given in my "Essay" are here computed by the formula now given, and for the sake of comparison, the former values are also inserted, as follows:

	By formula now given.	As before given.
When $\theta = 65°$	then $\tau = 38° \; 55'$	27° 17'
55	„ $\tau = 38 \quad 6$	25 13
45	„ $\tau = 36 \quad 35$	21 47
35	„ $\tau = 17 \quad 50$	15 38
25 40'	„ $\tau = 0 \quad 0$	0 0

If the ratio $\frac{r+e}{r}$ were omitted as suggested by B. H. B., the expression would become

$$\sin\tau = \pm\sqrt{\left\{\tan^2\theta + \left(\frac{a}{2c}\tan^2\theta - \frac{c}{2a}\right)^2\right\}} - \left(\frac{a}{2c}\tan^2\theta - \frac{c}{2a}\right) \qquad (B)$$

Now in this equation whatever may be the value of θ, the value of τ remains the same, and when the arc is a semicircle

$$\sin\tau = \frac{c}{a} = \frac{2}{3{\cdot}1416} = {\cdot}63661 = \sin 39° \; 32' \; 24''.$$

This result is in accordance with the speculations of B. H. B., but it is entirely at variance with practice and with correct theory, and so will any formula into which an expression for the thickness of the arch does not enter. The formula A now given contains it, and will be found correct. By this formula $\sin\tau$ continually approximates to, but never reaches $\frac{2}{\pi}$, and vanishes when $\theta =$ either 25° 40' or 90° as it ought to do.

B. H. B. says, "in finding a term for C O, I would reject the thickness of the cylinder, and consider the point O as that to which the tangents of the small curves, which show in the face of the arch tend: this is more correct, because the joints of the voussoirs being segments of curves there can be no point on the face of the arch at which a ball would roll down the bed in a line exactly parallel to the face; this may be considered too minute for observation, but besides being more correct it will simplify the question much."

Here, I beg to observe B. H. B. is again wrong, and for this reason; these curves of the joints in the face of the arch are all in a vertical plane, and if the thickness of the arch be rejected, they must be regarded as *lines merely*, and a ball would consequently roll down any one of them, or down the chord of any one of them.

My investigation proceeds upon the supposition that the chord of the small curve forms one side of a triangle, the tangent of the intradusal spiral another side, and a line at right angles to the face of the arch, the third side: this triangle must be supposed to exist in the thickness of the arch, and to be parallel to a tangent plane at the point sought, and therefore this is one amongst many reasons why the thickness of the arch should not be rejected, even if it were attended with the advantage stated by B. H. B., namely, that "it will simplify the question much." But instead of simplifying, B. H. B. has produced an equation without explaining how it is obtained, and which he has not been able to reduce to a form for direct solution.

He infers from his equation, "that in all arches of a moderate skew, the point τ is about 40° above the level of the axis of the cylinder;" but I have herein shown that when the thickness is omitted, the point is independent of θ, and always 39° 32' 24" above the axis.

Now, although B. H. B., with much complacency, has informed your readers that my last chapter "*had better have been omitted altogether*," I remain of a different opinion. That chapter commenced as follows. "It will naturally be asked to what extent of obliquity is it safe or practicable to construct an arch on the principles herein given? This question we will attempt a solution of, or at least to throw some light upon it." How far I have succeeded it is for others to decide. I am well aware that the subject is not exhausted, inasmuch as I have pursued it further since the publication of the essay, but I have herein confined my remarks to the matter contained in B. H. B.'s communication.

It may be proper to observe, that in all this investigation friction is not taken into account; but friction is an important element in bridge-building, indeed, no arched bridge of masonry would stand without it—if, then, an expression for friction were to enter into the equation, the value of $\sin\tau$ would be very much diminished. And for this reason, my first equation, as given in the "Essay," though not strictly accurate, is practically better than the amended one now given.

Let B. H. B. take up the subject involving friction in his conditions, and he may have an opportunity of rendering considerable service to the engineering profession.

Your obedient servant,

Manchester, May, 1840. GEO. W. BUCK.

ON LIMESTONE IN IRELAND.

An Account of the White Limestone which lies along the Coast of the County of Antrim, in Ireland. By WILLIAM BALD, F.R.S.E., M.R.I.A., &c., June 1837.

WHAT is the white limestone on the Antrim coast?

It is of the same geological composition and formation as the chalk strata in England; but it possesses a characteristic difference in being of much greater induration than in general the English chalk strata; the dynamic unit of the force of crushing, and fracturing it by weight may be taken as equivalent to nearly that under which the Scotch Craigleith sandstone moulders into ruin.

The white limestone lies under the basaltic rock, and in contact with it, it is generally allowed to differ from the chalk of the south of England only in its being of superior induration; the white limestone assimilates to it in the nature and arrangement of the flints, and organic remains which it contains. The flints as mentioned in a former paper, are dark and grey, some of them of a reddish tint. The large nodules of flint are sometimes from eight to twenty inches long. Organic remains occur in the flints; belemnites of the real kind are common, and generally petrified by spar of a calcareous nature and sometimes ammonites.

The white limestone rests on the mulatto, a rock consisting of grains of sand, with specks of green earth. This mulatto rock corresponds with the green sandstone found under the chalk strata in England; it also contains fossil remains.

Under the mulatto rock lies a bluish limestone containing much clay; this rock is analogous to the lias limestone of England, it abounds in animal remains.

Under the lias or blue limestone are beds of marl containing much clay, and in which are beds of gypsum or sulphate of lime (alabaster), and the rock underneath consists of sandstone of a reddish colour.

I have now traced the comparison between the strata connected with the white limestone in Ireland, and the chalk strata in England, so as to leave no doubt whatsoever of their entire and perfect identity with each other. Besides, my friend Dr. Smith, the father of English geology, whom I have known for more than twenty-two years, and who has been in the north of Ireland, and is acquainted with the Antrim limestone, agrees in the description which I have here given of it; further Dr. Smith informed me that the Antrim white limestone was rock of the same formation as Flamborough Head, in England.*

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* "*Carbonate of Lime.*—Almost all the varieties of marble and common limestone, together with those earthy concretions that take place in many natural springs and caverns, as also the numerous class of substances called

As to the hardness or induration of the white limestone; I gave a kind of dynamic unit of the labour or ordinary force employed in boring into it for the purposes of blasting, viz., that the force of two men striking with hammers were able to sink into the white limestone at the rate of one foot in depth in half an hour, (jampers 1⅝ of an inch in diameter, hammers about three pounds weight) then the elements employed were the momentum of the hammers, united to the power of the arm, and the time; this is the common labour or force employed. It may be asked what is the amount of it? But to answer this is rather difficult, because one element cannot be perhaps exactly determined, which is the force of the arm united to the momentum of the hammer; but the induration of any rock may be reached or measured in a more exact form; in boring with heavy iron cylinders, and merely working with the simple element of the descending force of the gravitating mass of the iron bar; and the amount of this force may be estimated by the number and length of the descending strokes, using the following formula. The momentum of a body falling is the mass or weight multiplied by the square root of the height it has fallen through and by 8·021.

The number and length of the strokes, and the time occupied would be the measure of the force employed in sinking to any depth in any kind of rock, and this indeed might be used as a standard of comparison to measure the amount of the manual labour employed in boring through all the varieties of rock.

Sir John Robison, the ingenious secretary of the Royal Society of Edinburgh, observes with great truth that much depends on the shape and condition of the cutting point of the bar employed in boring, and also on the goodness of the steel and iron. In operations of this kind approximate results can only be obtained, and these should never be determined, regarding any particular rock, without numerous experiments on all the varieties it would present.

The hardness or induration of rock, as well as its strength to resist crushing by weight are matters of high importance to the engineer; but has any scale yet appeared to measure the amount of these two properties?

The weight which rock can sustain without crushing or fracture, may I think be taken as the amount of its strength. And the measure of its induration or hardness to resist perforation may be determined by the momentum of the descending strokes of an iron bar, and the time employed. The law of the relation of strength compared to hardness may be then traced from these results in all the various kind of rock strata.

What are the causes of the disentegration of the white limestone? *i. e.* the chemical agents which act so powerfully in decomposing its structure? To what cause does it owe its great hardness? If it be ascribed to heat from its close vicinity to the trachyte formations, the lava of the more ancient revolutions, and which I admit is a natural inference; but then on the other hand, I ask to what cause can be ascribed the high induration of the secondary limestone which covers so extensively the plains of Ireland, so far removed from any kind of volcanic remains or formations?

Indeed since the discovery of the carbonic acid gas contained in limestone by the illustrious Dr. Black, the science of chemistry has achieved but little practically in unfolding the chemical properties which give induration to the various strata of the older series, and among which are to be seen the most beautiful, as well as the most imperishable material for engineering works to be found on the globe. Some of these rocks have been wrought at periods so extremely remote that there is difficulty sometimes even to fix the epoch, yet some of them carry on their surface the sharp unimpaired lines of the tool after a lapse of more than three thousand years, and this is fully proved and illustrated in glancing at the granites and sienites employed in the construction of those surprising monuments of Egyptian antiquity, which have astonished all ancient and modern travellers.

In concluding, I find that Mr. Playfair, who ranks so high in the annals of science, has alluded to the black veins which traverse the white granular marble of Carrara having a resemblance to the sutures in the human scull:—are those very remarkable fissures confined alone to the calcareous strata?

It appears that Herm granite is effectually crushed by a pressure of 6·64 tons on the superficial inch; and that a cube of it containing 64 inches weighed 6 lbs. 6 oz., consequently a cubic foot weighs 172·125 lbs., and that there is 13·013 cubic feet to the ton; then it takes 6·64 tons, or 86·41 cubic feet of its own mass to crush one superficial inch, consequently a column an inch square of Herm granite containing 86·41 cubic feet would reach to an elevation of 12,443 feet, or 2 miles and 628 yards high, or 36 times higher than St. Paul's Steeple,* before it would reach its maximum elevation of crushing by its own weight at the base.

Craigleith stone is crushed by about 3 tons weight on the superficial inch,—137½ cubic inches weighed 11 lbs. 10 oz., a cubic foot than 146·094 lbs., being 15·34 cubic feet to the ton, or 46·02 cubic feet of its own mass to crush a superficial inch. A column of Craigleith stone containing 46·02 cubic feet and one inch square would crush at its base by its own weight at the height of 6624 feet, or one mile and 448 yards, being more than 19 times the height of St. Paul's steeple.

A four sided pyramid of Herm granite whose side at the base would be one inch and containing 86·41 cubic feet, would reach an elevation of 37,329 feet, or 7 miles and 123 yards before it would be crushed by its own weight at the base, equal to 109 times the height of St. Paul's steeple.

And a four sided pyramid of Craigleith stone whose side at the base would be one inch, and containing 46·02 cubic feet, would reach an elevation of 19,872 feet, or 3 miles and 1344 yards, before it would be crushed by its own weight at the base, equal to more than 58 times the height of St. Paul's.

PUBLIC BUILDINGS IN LONDON.

A Critical Review of the Public Buildings, Statues and Ornaments in and about London and Westminster—1734.

By Ralph.

[In consequence of this pamphlet being out of print and very scarce, we have deemed it advisable to reprint such portions as relate to those buildings that still remain undisturbed. Ever since its first appearance, it has always been read by the architect with considerable interest. It was printed anonymously, but it was well known to be by an eminent critic of the day, Ralph, the progenitor of Ralph Redivivus, whose effusions have occupied several numbers of our Journal, and created considerable interest in many of our architectural readers; but since the latter has deserted us, we hope only for a short period, we shall occupy occasionally our pages with some extracts from the above work.]

As nothing contributes more to the grandeur and magnificence of a city, than noble and elegant buildings, so nothing produces a heavier censure on a nation's taste than those which are otherwise; it is for this reason highly laudable to stir up the public to an attention, to such elegant and proper decorations as these, not only in regard to the fame of the people in general, but their interest too. One of the chief reasons why Italy is so generally visited by all foreigners of genius and distinction, is owing to the magnificence of their structures, and their number and variety; they are a continual bait to invite their neighbours to lay out their money amongst them, and one may reasonably assert, that the sums which have been expended for the bare sight of those elegant piles, have more than paid the original charge of their building. This Louis XIV. was sufficiently apprized of when he undertook Versailles, and the company that single fabric only has drawn into France, has made that crown ample amends for the expence of erecting it; and they have both the use and reputation of it still into the bargain.

It is high time, therefore, for us to look about us too, and endeavour to vie with our neighbours in politeness, as well as power and empire. Towards the end of King James I.'s reign, and in the beginning of his son's, taste made a bold step from Italy to England at once, and scarce staid a moment to visit France by the way. From the most profound ignorance in architecture, the most consummate night of knowledge, Inigo Jones started up a prodigy of art, and vied even with his master Palladio himself. From so glorious an out-set, there was not any excellency that we might not have hoped to obtain, Britain had a rea-

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calcareous spars, consist almost entirely of lime in chemical combination with carbonic acid or fixed air, the former constituting somewhat less than three-fifths, the latter somewhat more than two-fifths of their whole weight. Hence in scientific language they are called carbonates of lime. The carbonic acid or fixed air may be expelled by heat, or by the addition of any other acid: in the latter case an effervescence takes place, and this effervescence is a very distinctive character of calcareous carbonates, (page 2.)

" Marbles and limestones are with respect to their chemical analysis the same, they differ only in their uses and external character.—(Page 3), *Kidd's Mineralogy*.

Limestone chalk.	
Lime	53
Carbonic acid	42
Silex and alumine	2
Water	3
	100 Kirwan.

* Taking the steeple at 340 feet.

sonable prospect to rival Italy, and foil every nation in Europe beside. But in the midst of these sanguine expectations, the fatal civil war commenced, and all the arts and sciences were immediately laid aside, as no way concerned in the quarrel. What followed was all darkness and obscurity, and it is even a wonder they left us a monument of the beauty it was so agreeable to their natures to destroy.

Wren was the next genius that arose to awake the spirit of science, and kindle in his country a love for that science which had been so long neglected; during his time a most melancholy opportunity offered for art to exert itself in the most extraordinary manner: but the calamities of the present circumstance were so great and numerous, that the pleas of elegancy and beauty could not be heard, and necessity and conveniency took place of harmony and magnificence.

What I mean is this: the fire of London furnished the most perfect occasion that can ever happen in any city, to rebuild it with pomp and regularity; this Wren foresaw, and, as we are told, offered a scheme for that purpose which would have made it the wonder of the world. He proposed to have laid out one large street from Aldgate to Temple-bar, in the middle of which was to have been a large square, capable of containing the new church of St. Paul's, with a proper distance for the view all round it; whereby that huge building would not have been cooped up, as it is at present, in such a manner as nowhere to be seen to advantage at all, but would have had a long and ample vista at each end, to have reconciled it to a proper point of view, and give it one great benefit which, in all probability, it must now want for ever. He farther proposed to rebuild all the parish-churches in such a manner as to be seen at the end of every vista of houses, and dispersed in such distances from each other, as to appear neither too thick nor thin in prospect, but give a proper heightening to the whole bulk of the city as it filled the landscape. Lastly, he proposed to build all the houses uniform, and supported on a piazza, like that of Covent Garden; and, by the water-side, from the Bridge to the Temple, he had planned a long and broad wharf, or key, where he designed to have ranged all the halls that belong to the several companies of the city, with proper warehouses for merchants between, to vary the edifices, and make it at once one of the most beautiful and most useful ranges of structure in the world. But, as I said before, the hurry of rebuilding, and the disputes about property, prevented this glorious scheme from taking place.

In our own times an opportunity offered to adorn the city, in some degree; and though the scarcity of ground in London will not allow as much beauty of situation as one would desire, yet if the buildings were suited to their place, they would make a better figure than they do at present. I have now the late new churches in my eye; amongst all which, there are not five placed to advantage, and scarce so many which are built in taste, or deserve half the money which they have cost; a circumstance which must reflect on the judgments of those who chose the plans, as well as the genius of the architects themselves.

No nation can reproach us for want of expence in our public buildings, but all nations may for our want of elegance and discernment in the execution. In the first place, there are very few of our fine pieces of architecture in sight; they are generally hid in holes and corners, as if they had been built by stealth, or the artists were ashamed of their works; or else they are but essays, or trials of skill, and remain unfinished, till Time himself lays them in ruin. After this, it is unnecessary to mention that our structures are generally heavy, disproportioned, and rather incumbered than adorned; beauty does not consist in expence or decoration; it is possible for a slight building to be very perfect, and a costly one to be very deformed: I could easily name instances of both kinds; but, as I propose to point out to my readers most of the edifices about town that are worth consideration on either side, I will not anticipate my design, but exemplify my meaning, as I proceed, and leave the public to make use of it as they please.

To begin with the remotest extremity of the town; as there were no attempts, till lately, ever made there, to erect any building which might adorn it at all, there was the more necessity to be more particularly careful that the first design of this nature should not miscarry; and yet the four following churches which have been built at Limehouse, Ratcliff, Horsley-down, and Spittal-fields, though they have all the advantage of ground which can be desired, are not to be looked at without displeasure. They are mere Gothic heaps of stone, without form or order, and meet with contempt from the best and worst tastes alike. The last, especially, deserves the severest condemnation, in that it is built at a monstruous expence, and yet is, beyond question, one of the most absurd piles in Europe.

As a fabric of antiquity, it is impossible to pass by the Tower without taking some notice of it, particularly, as it is visited so much by the good people of England, as a place made venerable by the frequent mention which has been made of it in history, and famous for having been the scene of many tragical adventures; but I must caution those of my readers who are unskilled in architecture, not to believe it either a place of strength, beauty, or magnificence; it is large and old indeed, and has a formidable row of cannons before it, to fire on rejoicing days.

The front of the church lately rebuilt in Bishopsgate Street is, I think, more in taste than most about town; the parts it is composed of are simple, beautiful, and harmonious, and the whole deserves to be admired, for pleasing so much, at so little expence.

From hence we may pass on to the South Sea House, and there we shall have some reason to wonder that, when the taste of building is so much improved among us, we see so little sign of it here; at the same expence they might have raised an edifice which would have charmed the most profound judges; beauty is as cheap as deformity with respect to the pocket, but it is easier to find money than genius, and that is the reason so many build and so few succeed.

The tower of St. Michael's, Cornhill, though in the Gothic style of architecture, is undoubtedly a very magnificent pile of building, and deserves very justly to be esteemed the finest thing of that sort in London.

The Monument is undoubtedly the noblest modern column in the world: nay, in some respects it may justly vie with those celebrated ones of antiquity, which are consecrated to the names of Trajan and Antonine. Nothing can be more bold and surprising, nothing more beautiful and harmonious; the bas relief at the base, allowing for some few defects, is finely imagined and executed as well, and nothing material can be cavilled with but the inscriptions round about it. Nothing, indeed, can be more ridiculous than its situation, unless the reason which is assigned for so doing. I am of opinion if it had been raised where Cheapside Conduit stood, it would have been as effectual a remonstrance of the misfortune it is designed to record, and would at once have added an inexpressible beauty to the vista, and received as much as it gave.

The church in Walbrook, so little known among us, is famous all over Europe, and is justly reputed the master-piece of the celebrated Sir Christopher Wren. Perhaps Italy itself can produce no modern building that can vie with this in taste or proportion; there is not a beauty which the plan would admit of, that is not to be found here in its greatest perfection, and foreigners very justly call our judgment in question for understanding its graces no better, and allowing it no higher a degree of fame.

The steeple of Bow church is another master-piece in a peculiar kind of building, which has no fixed rules to direct it, nor is it to be reduced to any settled laws of beauty; without doubt, if we consider it only as a part of some other building, it can be esteemed no other than a delightful absurdity: but if either considered in itself, or as a decoration of a whole city in prospect, not only to be justified but admired. That which we have now mentioned is beyond question as perfect as human imagination can contrive or execute, and till we see it outdone, we shall hardly think it to be equalled.

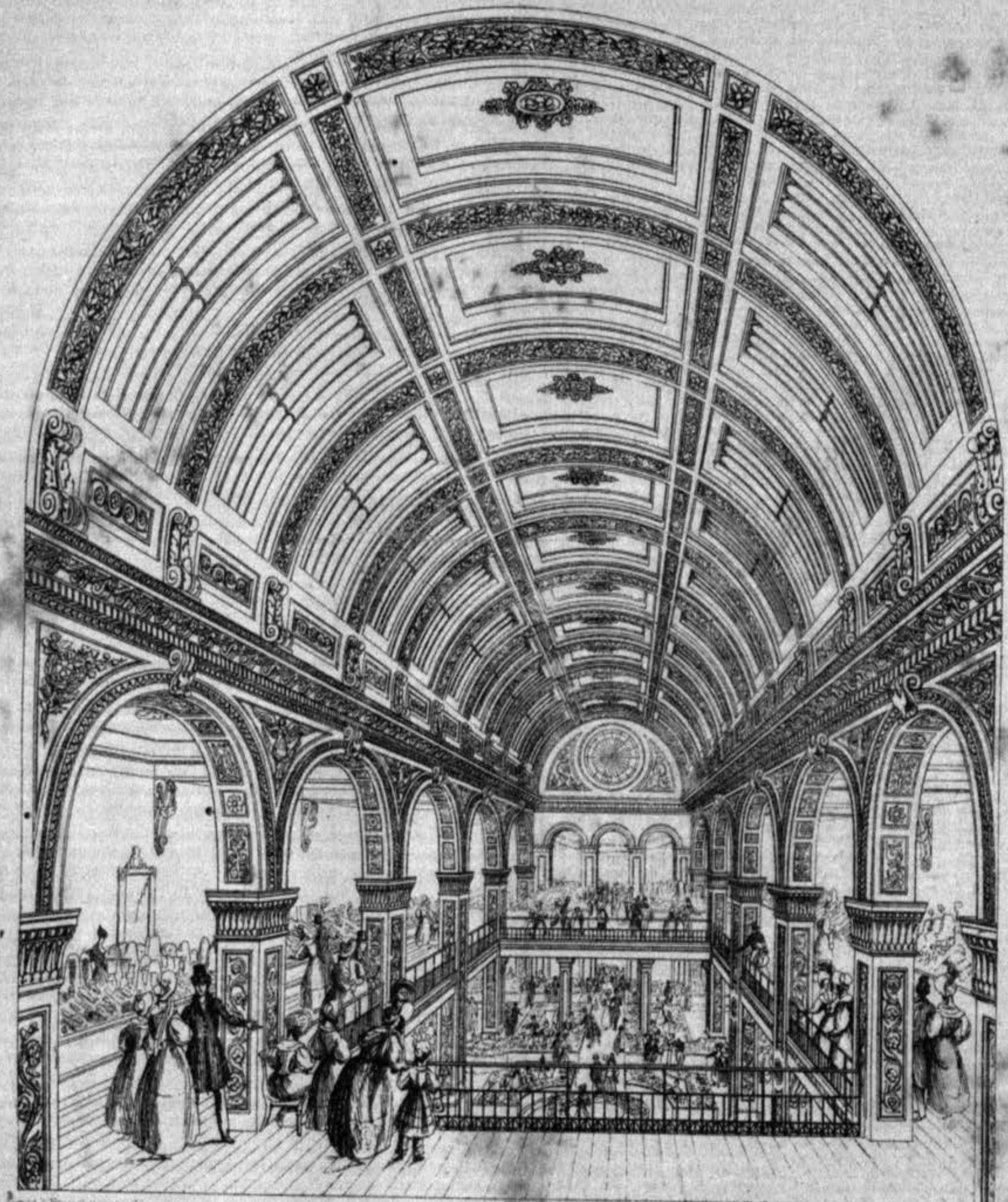
I think it proper to recommend the steeple of Foster Lane to the attention of the passenger; it is not a glaring pile that strikes the eye at the first view with an idea of grandeur and magnificence: but then the beautiful pyramid it forms, and the just and well-proportioned simplicity of all its parts, satisfy the mind so effectually, that nothing seems to be wanting, and nothing can be spared.

The new church in Old-street is so slight and trifling a building that it is not worth the trouble of a visit; for which reason we shall choose rather to cross over to Smithfield, neglecting the *Chartreux* (Charter-house), at the same time, because the building is so entirely rude and irregular, that it admits of nothing like criticism: its situation indeed in the midst of a garden is fine, and the square in the front of it is at least kept in better order than most in town.

In Smithfield we shall see a vast area, that is capable of great beauty, but is at present destitute of all; a scene of filth and nastiness, one of the most nauseous places in the whole town; it is true, the use which is made of it as a market is something of an excuse for it, and in some degree atones for the want of that decency which would improve it so much: yet still it is my opinion that ways and means might be found to make it tolerable at least, and an obelisk, pyramid, or statue, in the centre, defended with handsome and substantial rails, would go a great way in so desirable a project.

On one side of this irregular place is the entrance, not the front, of a magnificent hospital; in a taste not altogether amiss, but so erroneous in point of proportion, that it rather offends than entertains; but what is still more provoking, the building itself is entirely detached from the entrance, and though so near a large and noble opening, is in a manner stifled with the circumjacent houses: it is indeed a building in a box or case; and though beautiful in itself and erected at prodigious expence, is so far from giving pleasure to a judge, that he would rather regret its being built at all. It is certain that where

PLATE, XI.



Ornaments & Enrichments throughout this building Modelled & Executed in Papier Maché by C. F. Bielefeld, Wellington St. North, Strand, from designs by Sydney Smirke Esq.

View of the great Saloon of the Pantheon, London,
from the North Gallery.

Civil Engineer and Architect's Journal. June, 1840.

J. R. Jobbins, Lith. Warwick Ct.

the ground will admit of it, public buildings can hardly be too grand and magnificent; but where they cannot be seen when finished, use and convenience only should be consulted, and a pile of rough stones from the quarry, would answer the end, as well as the marble of Egypt with the decorations of Greece or Rome.

Newgate, considered as a prison, is a structure of more cost and beauty than was necessary, because the sumptuousness of the out-side but aggravates the misery of the wretches within: but as a gate to such a city as London, it might have received considerable additions both of design and execution, and abundantly answered the cost in the reputation of building.

The Physicians College, in Warwick-lane, Newgate-street, (now occupied as a market on the ground floor,) a structure little known and seldom talked of, is a building of wonderful delicacy, and eminently deserves to be considered among the noblest ornaments of this city; and yet so unlucky is its situation, that it can never be seen to advantage, nay seldom seen at all, and what ought to be conspicuous to every body, is known only to a few, and those too people of curiosity, who search out their own entertainments, and do not wait for the impressions of vulgar reports or common fame, to excite their attention or influence their judgments.

The hall of justice at the Old Bailey, and indeed all the courts I have ever yet seen in England are justly to be excepted to, as wanting that grandeur, that augustness, that decency, and solemnity which ought to be inseparable from them, in order to give men in general a suitable awe for the place, and strike offenders with a terror, even more forcible than the sentence they were to undergo. The form of a theatre agrees best with a place of this nature: that part of the building which is the stage, would answer exactly for the bench, the pit for the council, prisoners, &c., and the circle round it, for the spectators: but the present form of these assemblies is utterly opposite to this regularity, and instead of representing the whole in one grand and comprehensive view, divides it into meanness and confusion.

(To be continued.)

PAPIER MÂCHÉ.

Extracts from an Historical Account of the Application of Papier Mâché for Architectural Ornaments. By Charles Frederick Bielefeld.

WITH AN ENGRAVING, PLATE XI.

Of the Interior of the Pantheon, Oxford Street.

[The following account we have selected from the preface to Mr. Bielefeld's work on Papier Mâché ornaments; the subjoined plate shows how far Papier Mâché may be introduced with considerable taste, and a richness of effect produced, which is not so easily obtained by any other kind of ornament at the same expence, besides the facility it affords in being fixed immediately the carpenters' work is finished, and painted directly afterwards.]

"Though paper be one of the commonest bodies that we use, there are very few that imagine it is fit to be employed other ways than in writing, or printing, or wrapping up of other things, or about some such obvious piece of service, without dreaming that frames of pictures and divers fine pieces of embossed work, with other curious moveables, may, as trial has informed us, be made of it."—(Of man's great ignorance of the uses of natural things; Boyle, vol. iii. page 485, ed. M.DCC.LXXII.

Notwithstanding the name that has been given to the material, which would seem to imply that it is of French extraction, there is yet very good reason to believe that to England is to be attributed the merit of first applying this manufacture to important uses. Light and trivial articles, such as snuff-boxes, cups, &c. had, on the Continent, been made of Papier-Mâché for a long course of time; but, from the following passage from an article "sur l'Art de Moulage," in the "Encyclopédie Methodique," we may safely conjecture that here first it was applied to the builder's purposes: "Les Anglois font en carton les ornamens des plafonds que nous faisons en plâtre: ils sont plus durables; se détachent difficilement, ou s'ils se détachent, le danger est nul et la reparation est peu dispendieuse." (Vol. v. Paris, 1788.) We may here take occasion to remark, that the writer of the above passage appears to have perfectly understood the peculiar merits of Papier-Mâché; and it would be impossible to explain more concisely or more accurately than in that short paragraph, the more valuable qualities of this material. The particular circumstances that gave rise to the adoption of Papier-Mâché by the architectural decorator in England, deserves the especial notice of all who are interested in the welfare of our manufactures.

It should be premised, that with the Elizabethan style, or the "rénaissance," of England, enriched plaster ceilings were very generally brought into use, and in the more classic or Italian styles that followed, the same material was still more extensively and more boldly employed. As the art advanced, plaster became partially substituted for carved or panelled wood wainscoting on walls; both in that situation and upon ceilings, foliage of the highest relief and of the richest character, may at the present day be found in the more important edifices remaining of the 17th and beginning of the 18th centuries: these enrichments were generally worked or rather modelled by the hand upon the stucco in its place, whilst still in a soft and plastic state.

As this work had to be done on the spot, and with much rapidity of execution, in order to prevent the stucco from setting before it had acquired the intended form, the art was somewhat difficult; the workman had to design almost as he worked: therefore, to do it well, it was necessary that he should have some of the acquirements and qualities of an artist. This circumstance of course tended very much to limit the number of workmen, and their pay became proportionably large.

It was no unnatural consequence that artisans thus circumstanced assumed a consequence that belonged not to their humble rank in life; it is said that they might have been seen coming to their work girt with swords, and having their wrists adorned with lace ruffles. Such a state of things was, as may be conceived, attended with many inconveniences to their employers; it was scarcely possible to preserve that subordination so essentially necessary in carrying on the business of a builder, and ultimately the workers in stucco, laying aside all restraint, combined together to extort from their employers a most inordinate rate of wages. It would be superfluous here to detail all the circumstances that followed; it is sufficient to state that, as might have been anticipated, the total ruin of their art was the final result of these delusive efforts to promote their individual interests.

Contrivances were resorted to by the masters, which soon supplanted the old mode of working in stucco. The art of moulding and casting in plaster, as previously practised in France, was generally introduced, and the art of preparing the pulp of paper became improved and extended, so as ultimately to render practicable the adoption of Papier-Mâché in the formation of architectural decorations. Thus at last was extinguished the original mode of producing stucco ornaments, and there probably has not been for many years a single individual in England accustomed to that business.

The superior cheapness of the process of casting in plaster brought it into almost universal use; for, although in the course of the last century an immense trade was carried on in the manufacture* of architectural and other ornaments in Papier-Mâché, yet the poverty of taste they generally displayed, and the imperfection of machinery at that time, which prevented this material from coping with plaster in respect to price, ultimately caused its disuse. The manufacturers of Papier-Mâché at that period do not seem to have been aware of the great improvements of which every process of their art proves now to have been susceptible.

A most mischievous effect, however, was produced in the art of decorative designing by this change in the mode of execution. All the deep undercuttings and bold shadows which marked the style of design in the age of Queen Anne, became impracticable when ornaments were to be cast. A meagre, tame, *petite* manner ensued almost of necessity, until by the end of the last century the art of designing architectural ornament had fallen into a deplorable state of imbecility.

The subsequent introduction of Greek ornament formed a new era: the limited capabilities of plaster-casting became then less inconvenient, for the broad, flat character of the Greek style was favourable to the process of casting, and had that manner of designing continued to prevail generally up to the present day, it is probable that no material change would have taken place in the manufacture of ornament. But great fluctuations have occurred in the public taste: the pure and elegant simplicity of Greek ornament is in its nature appreciable only by the more highly cultivated tastes; the generality of persons do not understand its merits; therefore, after the stimulus of novelty had ceased to operate, fashion soon led the public favour into other channels. The bold originality of the Gothic school, the gorgeous and meretricious richness of the Flemish and French schools, the picturesque and fantantic forms of the Elizabethan style, soon found many admirers, and it is this great change in the manner of designing ornament that has given rise to the important improvements in the manufacture of the highly plastic substance called Papier-Mâché. Plaster is totally inapplicable to the exact imitation of the bold florid carvings in the above named styles, whilst to carve in wood all these fanciful forms would occasian a cost far beyond the means of all ordinary purses. As to the putty-composition, a material introduced at the latter end of the last century as a substitute for wood carving in picture frames, &c. its monstrous weight, its brittle, impracticable nature, and the difficulties and heavy expenses necessarily incurred in its manufacture, as well as in fixing it up, render it properly applicable to a very limited range of purposes.

Having made these preliminary remarks upon the origin of Papier-Mâché, and the causes of its improvement and re-introduction, we will proceed to the more important objects of the present brief essay, and describe, for the information of practical men, the mode of applying the material to the various uses for which it is so admirably adapted. We will only premise, that the application of steam power, and the vast improvements that have of late been made in all branches of mechanics, have enabled the present manufacturer to produce a material alike only in name to the Papier-Mâché of the last century: its hard compactness, its strength, its imperishable nature, its tractability (if such an expression may be allowed), the facility with which it may be put together and fixed up, its lightness, the rapidity with which it may be prepared and fixed, and finally its cheapness, are qualities which eminently distinguish it, but which cannot perhaps be fully appreciated but by those who have had extensive experience in its use.

Papier-Mâché is applied to the enriched cornices of bookcases and cabinets, to the mouldings and corners and centre ornaments of paneling on their doors and sides; to the enriched scroll legs of cabinets and pier tables in the old French style; to ornamental brackets for clocks, busts, vases, &c.; to the enriched borders to rooms hung with silk or paper; the ornamental parts for picture and glass frames, no matter how curved and elaborate; also to window-curtain cornices, the canopies of bedsteads, &c. &c. It has been very advantageously used for the latter purpose in the state bed at Chatsworth; and also to the canopy of the Royal Throne in the present House of Lords. For the enrichment of bookcases it is admirably adapted, affording opportunities, if in the Gothic style, of introducing elaborate pinnacles and pendants, rich corbels and pierced frets of open work, deeply undercut rosettes, and spandril and mitre, or intersection ornaments, &c.; also for the exterior cases of organs it has been most advantageously and extensively used: the lightest and most intricate tracery is executed with ease, and an effect produced at a very moderate cost, which by no other means could be obtained without an extravagant expense.

It is needless to add, that when the above mentioned subjects are in classic or other styles, the friezes, the scrolls, consoles, pateras, &c. are among the simplest and most obvious uses of Papier-Mâché.

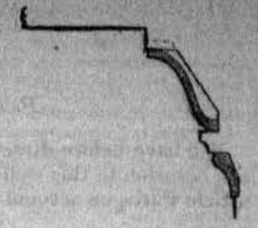
With regard to the mode of fixing Papier-Mâché in cabinet work, perhaps the simplest and yet most accurate rule that can be laid down, is to treat it exactly as if it were wood. It is to be cut with the saw and chisel, and may be bent by steam or heat, planed and cleaned up with sand paper to the smoothest face and to the finest arris, if required; it is to be fastened with brads, needle points, or glue. The larger objects, such as brackets, canopies, &c. can be made either with a wood core, or they can be wholly of Papier-Mâché: in either case, two or three screws at once secure them in their place. When fixed, the work can be painted and grained without any previous preparation whatever; and in gilding, the surface of the work is so much better adapted to receive the gold than that of any other material, that much of the expense and delay usually attendant on the process is saved. The same observation applies to silvering; and it may be added, that there is good evidence (as at Chesterfield House, May Fair, &c.) to prove that the metallic leaf continues untarnished longer on Papier-Mâché than on other substances.

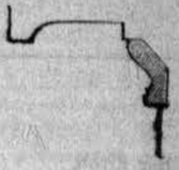
A great variety of brackets, consoles, and cantilevers are made of this substance; indeed, one of the first applications of C. F. Bielefeld's improved Papier-Mâché to architectural purposes, was to form some large consoles and cornices at St. James's Palace on the accession of his late Majesty. Since that time similar work has been fixed up at the Grocers' Hall, the King's College, at the Carlton Club House, the Oxford and Cambridge Club House, British Museum, State Drawing Rooms at Dublin Castle, Grand Lodge Freemasons' Hall, Corn Exchange, &c. Chimney pieces are very effectively decorated in Papier-Mâché, as was formerly much practised by Sir William Chambers and others; specimens of ornamental chimney pieces in the style of Elizabeth and James may be seen in the show rooms. It would, however, be tedious to enumerate all the purposes to which Papier-Mâché can be advantageously applied; it will suffice to repeat, that there is no possible enrichment, in any style, however complicated or elaborate, that may not be readily executed in it. Nor is the manufacturer disposed to limit the application of it to interior work. The improved Papier-Mâché is of too recent introduction to enable us to refer to any example of its use in exterior work further back than about fourteen years; but there are several shop fronts in London that were fitted up at that time, where the Papier-Mâché enrichments are at the present day as sound and perfect as when first turned out of the mould. We may, however, find in the Papier-Mâché of the last century, although of immeasurably inferior quality, abundant proof of its extreme durability in exposed situations. Sir William Chambers's own house in Berners-street, that must be probably three quarters of a century old, has the Papier-Mâché, which enriched the fanciful architecture at the back of the house, in perfect preservation.

At Paris, the Carton-pierre, a substance analogous to Papier-Mâché, but in every way inferior to it, especially as regards its durability, being very absorbent of moisture, and therefore liable to become soft, is largely used for exterior ornaments, even in buildings of the most sumptuous and important character.

As there is good evidence of the durability of the old Papier-Mâché in the open air, it follows of course, that for interior work its permanency may be still more implicitly relied upon. There are many pier-glass frames, chimney-pieces, &c. composed of this substance, remaining in a perfectly sound good condition, that must have been made early in the last century; and a recent examination of the old Papier-Mâché work at Chesterfield House has most satisfactorily proved, that for ceilings it is equally durable; the component parts are, in fact, such as to render it much less likely to decay than the laths or other work to which it may be attached; and in no instance that has ever come under the observation of the manufacturer, has he detected the least indication of its having been attacked by worms, one of the ingredients used being very obnoxious to them. The Papier-Mâché work now remaining in many houses in London and the country, which was put up in the time of Sir William Chambers, appears, wherever it has been examined, in a perfectly sound state, notwithstanding all those original defects in its composition and manufacture which the manufactory has been able effectually to correct.

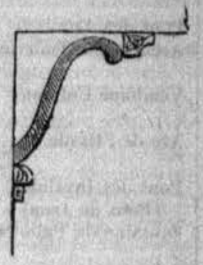
It now only remains to give some general instructions for the fixing up of the work. There is one rule which it will be particularly advisable to note, since it is calculated to save much trouble, and secure perfect truth in the fixing of the enriched members of cornices. In running the plain work of a cornice, it should be remembered to provide in the mould a sinking to receive the Papier-Mâché member. If, for example, it is desired to enrich with foliage the cyma of a cornice, the mould should be formed with a sinking thus: or, should it be desired to insert an enrichment, say an ogee and bead, in the bed-moulding of the cornice, a sinking to receive it should be provided thus:

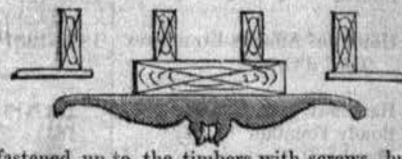




These sinkings need not generally exceed one-eighth of an inch; a raised fillet at the bottom of the enriched moulding would answer the same purpose, the only object being to secure a perfectly continuous and unbroken line.

In cases where a simple cornice would be sufficient, and where it is desirable to have nothing to do with plaster, a small fillet or moulding of wood, nailed to the ceiling and wall with the Papier-Mâché ornament inserted between them, gives a very complete and ornamental finish to the room at a most trifling expense, and without the dirt and delay unavoidably attendant on running plaster mouldings. Where a flower or patera has to be applied to a ceiling, one screw will suffice, unless the patera be of unusual dimensions, to attach it safely to the plaster, taking care that the screws are long enought to reach the joists. Where, however, the flower is intended to cover an opening for ventilation, it will be requisite to block down from the joists; thus screwing the flower to the blocking.





Where ornamental corners are to be applied to a ceiling, they should, if very heavy, be fastened up to the timbers with screws, but generally speaking it would be quite sufficient to use brads, taking their hold on to the laths; this attachment being made still more secure by the use of the cement which is prepared and provided by the manufacturer when required, together with instructions for using it. The same mode of fixing is adopted for frets, friezes, and indeed for all kinds of superficial enrichment, care being at all times taken that brads lay well hold of the laths, for which purpose it is generally expedient to drive the brads in at the hollows, and such parts of the work to be fixed; it is also a useful precaution to drive the brads in a slanting direction, so as to prevent all chance of their drawing. When walls have to be enriched with panels, as is very usual in apartments fitted up in the old French and Italian styles, exactly the same rules for fixing as have been above prescribed for ceilings are to be followed, except that fewer precautions are necessary, as the weight acts differently; where the work is of a very light character even common needle points will be found sufficient, but the cement above mentioned is in all cases an useful addition. With the assistance of the above rules, there is no sort of work in Papier-Mâché that may not be well fitted up by an ordinary joiner.

In drawing up these brief notes on the use of the improved Papier-Mâché, the manufacturer has yet to advert to a new application of it of almost unlimited extent, and one to which a higher degree of importance may justly be attached than any yet described.

There is no art to which the lovers of the Fine Arts, and especially of Sculpture, are more indebted than to the art of moulding and casting in plaster; but for this art we should be almost wholly ignorant of the merits of contemporary sculptors, and the glorious efforts of ancient art would be all but lost to the world. By means of plaster-casts the chef-d'œuvres of all ages are multiplied, and brought from the uttermost corners of the world into the museum of the connoisseur and the studio of the professor.

But how perishable and fragile is a plaster-cast! how cumbrously heavy! how difficult of transport! such indeed are the risks of breakage that no one is willing to pay for a cast, the price that would compensate for the difficulty and expenses necessarily attendant on making a perfect mould and cast. The result is, that the plaster-casts ordinarily sold are most imperfect and unsatisfactory representations of the works of art they are derived from. The new substance now under consideration presents itself to obviate all these inconveniences; for, whilst a copy of any piece of sculpture can be made in it with perfect truth and fidelity, its weight is scarcely one-sixth of that of plaster, and its liability to fracture less than that of stone, marble, or wood.

When these advantages, coupled with economy in price, are considered, it will be easily seen what facilities are now afforded for disseminating throughout the empire a knowledge of the best works of sculpture. The inventor hopes to place within the reach of every individual the enjoyment and advantages derivable from the contemplation and study of the finest specimens of this branch of the Fine Arts.

REVIEWS.

Penny Cyclopædia, Part 87.

We have before directed the attention of our readers, on more than one occasion to this well conducted publication, and now point out the article Paris, on account of the architectural remarks it contains on the principal public buildings, and likewise for the synoptical table which accompanies them, and which is drawn up upon the same plan as those of London and Munich. The arrangement is chronological, and divided into centuries. We extract the latter portion, or that comprising the edifices erected within the present century, more than which we do not consider ourselves at liberty to transfer to our Journal, else we should willingly give the entire table; but whether they take in the work or not, we have no doubt that most of our readers will procure the part containing the article from which our extract is taken.

Nineteenth Century.

	Date.	Architect.	Remarks.
Rue Rivoli . . .	1802	Percier . .	
La Madeleine . . .	1804-36	Vignon, Huvé, &c.	A Corinthian peristyle of 52 columns (8 at each end) 62 feet high, raised on a stylobate 13 feet high.
Pont des Arts . . .	1804	Cessart & Dillon	For foot-passengers only; arches cast iron, piers stone.
Arch of the Tuileries . .	1805-10	Percier and Fontaine . .	Each front has four Corinthian columns (shafts red marble, and bronze capitals), with a central arch and two smaller ones.
Vendôme Column . .	1806	Gondouin & Lepère . .	Stone cased with bronze reliefs; total height 141 feet.
Arc de l'Etoile . . .	1806-36	Chalgrin, &c. finished by Debret	Width 147 feet, height 162 feet, depth 73 feet. Arch 47 feet wide, 96 feet high.
Pont des Invalides (Pont de Jena) . .	1806	Lamandé .	Five arches, length 518 feet.
Fontaine du Palmier . .	1806-8	Bralle . .	A column on a pedestal, surmounted by a figure of Fame on a globe. Height to top of capital 49 ft. 3 in.: total height, with statue, 56 feet.
Portico, Chamber of Deputies	1807	Poyet . .	A single range of twelve columns (44 feet high) beneath a pediment.
Bourse	1808-1824	Brogniart & Labarre . .	A Corinthian peristyle of 64 columns (40 feet high), 14 at each end.
Hôtel des Affaires Etrangères (Quai d'Orsay)	1810-1837	Bonnard and Lecointe . .	An extensive pile, of which the projecting portion forming the façade towards the quay is 370 feet, and consists of two orders, Doric and Ionic, surmounted by an attic, and each containing 19 large arcades or windows.
Halle aux Vins . . .	1811-13	Gaucher . .	
Bondy Fountain . .	1811	Girard . .	A large circular basin 90 feet in diameter, with other basins or terraces rising from it.
Marché St. Germain . .	1813	Blondel, M. J. B.	
Chapelle Expiatoire . .	1815-23	Percier and Fontaine . .	Tetrastyle portico, Roman Doric attached to a square mass, whose three other sides have semicircular projections crowned by semidomes against the attic of the square part.
École des Beaux Arts .	1824-37	Duban and Labrouste . .	Two Corinthian orders (one in columns, the other in pilasters), upon a basement. The gateway or screen from Château Gaillon, erected in front of the building.
July Column . . .	1833	Alavoine . .	Pedestal stone, column bronze, total height 154 feet; 13 feet higher than the Vendôme Column.
Pont du Carrousel . .	1834-6	Polenceau . .	Timber and iron, with stone piers and abutments. Three arches, centre one 187 feet span, and 16½ rise. Total length 558 feet.
Palais de Justice . .	1834		Interior remodelled and rebuilt chiefly in the Renaissance style.
Hôtel de Ville . . .	1835	Godde and Lesueur . .	Restorations, &c. Renaissance style.
Luxor Obelisk . . .	1836		Raised by Lebas, October 25.
Place de la Concorde . .		Hittorff . .	Embellished with fountains and architectural decorations.
Notre Dame de Lorette .	1825-36	Lebas . .	Portico, tetrastyle Corinthian.
St. Vincent de Paul . .		Hittorff and Lepère . .	
Bazar Bonne-Nouvelle .	1837	Froehlicher and Grisart . .	
Church, Faubourg St. Germain	1839	Gau . .	Gothic.

We should like to see a complete series of such tables for all the principal cities of Europe, published separately, and would suggest this to the writer in the Cyclopædia, with whom the idea appears to have originated.

A Brief Description of the various Plans that have been proposed for supplying the Metropolis with Pure Water, also a short Account of the different Water Companies that now supply London.

The supply of water for domestic use is a subject which in all times has been regarded as one of great public importance, for, next to the air which we breathe, water is the most powerful agent in vital economy. It is a subject, indeed, which every year becomes of deeper interest, particularly to the inhabitants of a densely peopled metropolis; to vitiated air and vitiated water, and to an insufficient supply of both in purity, is owing the frightful mortality which attacks the inhabitants of towns when compared with those of the country, and we think that the Report of Mr. Farr to the Registrar General, will not do less towards effecting a reform of these evils, than the active agitation of the last ten years, or the labours of parliamentary committees. Much certainly has been done within the last ten years towards improving the supply of water, but much, very much, still remains to be done before the companies can be considered to have done their duty. The author of the pamphlet before us would have done wisely if he had omitted the following passage. "It is not intended, in the present day, that the inhabitants of London, generally, complain of the quality of the water supplied to them, although it still seems to be the policy of certain 'artful and mischievous persons' to use the words of a celebrated individual, now no more, by exaggerated statements to promote contention and inflame the passions of the inhabitants," Though these words are supported by a quotation from the great Telford, we must remember that he was speaking on a subject on which he had strong prejudices. Is it at all probable that the companies would have incurred the enormous outlay which they have done during the last ten years, we may say, within limits, to the tune of a million pounds sterling—if there had not been some truth in the statements of these "artful and mischievous persons," would the Grand Junction Company have removed their works from the "former objectionable site near Chelsea (Sewer?) Hospital" to Brentford, and incurred an expense of nearly £200,000, if it had not been for these "artful and mischievous persons." Our author also subjects himself to the same denomination, for he even has had the *temerity* to tell the Companies that the present mode of filtering as practised by them is insufficient effectually to cleanse Thames water of all the impurities which are suspended in it after heavy rains (vide page 9), and he recommends as the most effectual method, the plan of filtering through charcoal, which we shall hereafter notice. We believe that most of the Companies have done their best in endeavouring to improve their supply from the *Thames*, but whether *that* resort be the best for obtaining water is a subject well worthy of inquiry. We believe it is not disputed, by any party, that water obtained by the aid of deep wells and Artesian boring is far better than obtaining the supply from the Thames, as by the latter, enormous expences are annually incurred in filtering the water, besides the expense of pumping first the supply into a reservoir and thence to the mains, whereas by the former process the water might at once be pumped into the pipes, and forced up to the elevated situation, without the expense, trouble, or delay of filtering, or pumping a second time, but the objections to the former plan have been that a sufficient quantity of water cannot be obtained for this great metropolis, and also that any attempt to obtain a supply by such means would materially affect the numerous wells about the metropolis, particularly those which belong to the manufactories and the large breweries, the latter, until within the last 20 years, were supplied by the various companies, but in consequence of the heavy rental the brewers and manufacturers were compelled to pay, they had recourse to the sinking of wells of great extent, and, we believe, we may say safely, not one of them ever failed affording an ample supply, and if the companies do not take care, their other customers will be obliged to resort to the same means, as very little consideration of the geology of London would be sufficient to convince any one that an abundant supply of water for all, exists in the lower strata, in the same manner as at Paris, a description of which, in one of our recent numbers, will serve to illustrate the present subject.

Before we proceed further with our remarks, however, we must refer to the contents of the pamphlet which has given rise to this notice. The work is published anonymously, but we understand that it is by Mr. Peppercorne, a highly respectable member of the profession, and in no way connected with a gentleman of the same name acting as secretary to one of the metropolitan water companies.

The pamphlet first proceeds to describe the several metropolitan companies, how they obtain their supplies of water and the quality of it. It then details the various plans devised by the water companies, or by private individuals, which are divided into three classes:

> 1st. Those which propose the purification of the Thames water either by filtration or by subsidence, or by both combined, and which method has been put in practice on an extensive scale by some of the water companies.
>
> 2nd. Those which suggest the taking of the water supply from a higher part of the river than where it is now obtained.
>
> 3rd. Those which recommend to draw the supply from other sources than the Thames, and to convey it by means of extensive aqueducts to London.
>
> Respecting the first class, it is a well known fact that although filtration through sand, or through sand and gravel, (as in the case of the Chelsea water-works,) produces a perfectly clear and transparent fluid, free from sediment and colour, yet that it is insufficient to free the water from animal or vegetable impurities held in solution, or from any taint which the water may have thereby acquired; but that filtration through charcoal, or through sand and charcoal, as practised to some extent with the water of the Seine at Paris, is capable of removing the whole of the sediment, and also, by a properly regulated system, the entire of the animal and vegetable impurities contained in Thames water taken from the London district.
>
> With respect to the method of subsidence alone in reservoirs, as practised now by almost all the water companies, although a large portion of the muddy sediment contained in Thames water is thereby deposited, yet it is clear that it cannot free the water from all the impurities dissolved in it. The process of subsidence might, it is true, be made to free the water from nearly the whole of the animal impurities contained in it, but in that case the state of rest of the water, to be so purified, ought to continue for a much longer period of time than the companies usually allow, or can afford to allow. It has been ascertained that if Thames water be suffered to remain at rest, completly undisturbed, for a period of several weeks, fermentation will take place in consequence of the presence of animal and vegetable matter, and the liquid will become clear and transparent, with the exception of a small proportion of insoluble sediment, and will lose all unpleasant smell, taste, or colour. This curious fact was ascertained by Dr. Bostock, who communicated the result of his interesting enquiry to the Royal Society in 1829.
>
> Of the second class, it is only necessary to observe, that unless all the water companies, north and south of the Thames, were simultaneously to establish their works as far to the west as at Teddington, no removal to any part within the influence of the tide, could accomplish their intention of supplying a purer water than they now do to the metropolis.
>
> * *
>
> In regard to the third and last class of projects that have been submitted to parliament, it is only necessary to state in passing, that the one which seems to have been duly considered by a select committee of the House of Commons so late as 1834, and which was presented by the late Mr. Telford, involves so much difficulty, and the outlay of so exorbitant a capital for the supply of six only out of the eight water companies, that there appears to be no likelihood of its ever being carried into effect. It is not probable, indeed, that any government will authorize the expenditure of £1,200,000 for the construction of two aqueducts, the one sixteen, the other six miles in length, according to Mr. Telford's estimate, in order to bring water *of very questionable purity* from the Verulam and the Wandle to assist *six* only of the water companies of the metropolis.

We shall not stop now to make any inquiry as to the authority, which the author has for stating that the water from the Verulam and Wandle is "of very questionable purity" but shall reserve it until we notice another part of the pamphlet relating to Mr. Telford's evidence.

The author proceeds to give an interesting account of the numerous plans which have been devised since the year 1821, for supplying the metropolis, but as it is not our intention to notice all these schemes, we must confine ourselves to that part which relates to the supply from the Colne near Watford, the locality of the proposed London and Westminster Water Company, now occupying the public attention and a Committee of the House of Lords, and to which the following extracts from the pamphlet alludes.

> Among the numerous schemes for the so-called *better* supply of the metropolis with *pure* water, from other sources than the Thames, there are two which at the present time claim particular attention, from an abortive attempt that has been lately made to revive one at least of them. The one of these relates to the supply of the south side of the metropolis from the river Wandle, as proposed in 1834 by Mr. Telford, and the other of the north side from the Colne, also originally suggested by Mr. Telford, but the idea of which was abandoned by him owing to the insignificancy of its stream unless after heavy rains, when its waters were in a very turbid state. (See Mr. Telford's report March 1834, page 3.)
>
> With respect to the water of the Colne, Mr. Telford's experiments clearly proved that this river was totally inadequate in quantity for the supply of even *three* out of the five Water Companies on the north of the Thames, and that with regard to *quality*, it is frequently in so turbid and muddy a state, caused by its flowing over a *red soil*, as to be totally unfit for use.
>
> Mr. Telford indeed gauged *the river* Colne, and the result of his experiments showed that that river was *totally inadequate* for the supply of even *three* out of the five Water Companies on the north of the Thames.

These quotations, unsupported by other parts of Mr. Telford's report and evidence, would naturally, with a stranger to the subject, lead to the belief that the efforts now being made for establishing the proposed company are entirely delusive, and that all their statements are only intended to dupe the respectable individuals who are disposed to lend it their patronage. We have, therefore, thought it necessary to reperuse the reports and evidence, and also at the beginning of last month to visit the spot where the experiments are now being made.

Let us first explain the situation and course of the river Colne. It unites with the Thames near Isleworth, in its course to Watford, it receives several tributary streams; from Watford it proceeds (still under the name of the Colne) for a distance of about four miles, through Otters Pool, the scene of the company's experiments, and Bushey Mills, the place from which Mr. Telford proposed to take his supply, it then goes on to the place at which the river Verulam falls in; the Colne continuing on as a very small stream beyond this spot, to the north-east, towards Colney and South Mims, and the larger stream, the Verulam, proceeding to the north by St. Alban's, for some distance up the country—therefore it will be observed that the river is called the Colne from its junction with the Verulam to the river Thames. When Mr. Telford stated that the Colne is an insignificant stream, &c., it may be clearly seen by his evidence, that he alluded to that part of the stream above its junction with the Verulam, and he proposed to divert that part of the Colne, so as to prevent it from affording any supply to the intended water-works at Bushey Mills, on the banks of the Colne, but lower down the river, and that in his report he called that part of the river Colne from the junction of the two rivers to Watford "the Verulam," whereas as we have already shown, it is called "the Colne." We will now give a few extracts from the evidence of Mr. Telford to show that at that part of the Colne "Bushey Mills," there was an ample supply of pure water to be obtained in the driest season without filtration, or pumping, sufficient to supply the principal part of the metropolis. All this evidence the author has carefully kept out of view, for what purpose we will not pretend to say, unless from a misunderstanding of Mr. Telford's evidence.

Mr. Telford in his report to the Lords of the Treasury, February 1834, states, that after having examined the streams which fall into the river Thames in the vicinity of London, he found an abundance of pure, transparent water, within the distance of 16 miles on the north (of London), amply sufficient for the supply of three of the present companies on that side of the Thames, he then goes on to state that the eastern branch (of the Colne) called the Verulam, a transparent stream, occupies the St. Alban's Valley, and about half way between St. Albans and Watford, the Colne joins the Verulam; but, unless after heavy rain, the Colne is an insignificant stream, and at such time very muddy, wherefore it is intended to exclude the Colne from furnishing any part of the supply of water.

Mr. Telford farther states in this report that "at Watford Mill" (near the spot the proposed company intend to erect their works), "in the autumn of 1833, being the driest season, as regards the supply of rivers, experienced during the last half century, the Verulam river produced upwards of 30 cubic feet of water per second; being more than double the quantity supplied by the three companies in the year 1828, namely, 13 cubic feet per second;" and as a farther proof, to show that Mr. Telford proposed taking his supply from near the spot, the proposed company have selected, he says, "Immediately above the commencement of the intended London Aqueduct, about two miles above Watford, the valley of the river Verulam affords a commodious situation for extensive reservoirs of water, and for allowing it to settle, if such should hereafter be deemed requisite. From this place a covered aqueduct may be made to descend with a uniform inclination of 18 inches per mile to Primrose Hill, terminating in a set of extensive receiving and distributing reservoirs, at the height of 146 feet above high water Trinity."

This report is again supported by the subsequent evidence of Mr. Telford, given in the report from the select committee of the House of Commons, 1834, from which we select the following.

23. What part of the River Verulam do you take the first portion of your supply from?—The supply is taken about half way between Watford and St. Albans; the whole supply for the north side is taken there.

24. Is it from a place called Grove Mill?—No, we do not take any from Grove Mill; Bushey Mill is the place. We make no use of the waters of the Gade. There are six paper-mills immediately above Grove Mill.

29. With reference then to the River Verulam, you think that, as it would only be necessary to apply it to the districts now served by the three companies at the west end of London, that the River Verulam would supply a quantity sufficient?—Quite so; for what I have estimated is without reservoirs; but from the usual summer supply of the river, a great deal might be added if it were necessary; perhaps a third more by making reservoirs for retaining flood water in that valley, but at present that is not wanted, because the quantity in the dryest season known for thirty years, was upwards of 30 cubic feet per second, which is more than double what the three companies have now.

35. There is no other part of the Colne according to your opinion then that would furnish an improved supply to London, except this River Verulam, which you would take unpolluted, at the point of junction with the Colne?—Below the junction of the Colne. We must divert the Colne. The Colne has in summer time very little water in it; we could not get a cubic foot of water per second; in rainy weather there is a considerable quantity, but as it passes through a red soil, it is very muddy, and therefore we must divert it, and never let it go into the River Verulam at all, until it has passed the point where the London aqueduct is taken off.

36. But alluding to those delta streams which the various sources commonly called the Colne eventually form, is it your opinion that any of those branches are sufficiently pure and good for the supply of London?—The Verulam is the only one.

37. No other branch of the Colne is sufficiently good for the supply of London?—No, not the Colne.

69. Then none of the branches of the Colne which appear to lay more conveniently near to London, are, in your opinion, fit for the supply?—Not so fit as the Verulam by any means.

70. Not in point of purity of water, nor being able to get high service?—Just so; those were the two reasons that struck me.

71. Did you propose to make a covered aqueduct?—Yes, I did.

87. Where does the Verulam fall into the Colne?—It falls in about half way between Watford and St. Albans.

88. Are you aware of any ornamental sheets of water upon the Colne below the point at which you propose to divert the water by the aqueduct for the supply of London?—No, I am not.

89. Did you search to ascertain whether there were any or not?—There were none occurred to me.

90. The Committee observe that the stream which is commonly called the Colne, from St. Albans down to Watford, until it arrives at Otter's Pool, is not, in point of fact, the river which you mean by the Verulam?—Yes, the St. Albans river is the Verulam.

91. You have stated that in dry weather that smaller branch which is called the Colne, and which flows in the neighbourhood of Otter's Pool, has very little water?—It had not a cubic foot per second when we measured it twice.

92. Well then, in dry weather every seat which is below Otter's Pool must feel the abstraction of this River Verulam, every seat between that and the Thames?—No doubt of it.

93. Will you tell the Committee the minimum of water that runs down the Verulam at the place where you propose to take from it?—Thirty cubic feet was the minimum.

94. In what time?—Per second.

95. Will you also tell the Committee what is the largest quantity or the maximum quantity of water that you expect would be necessary to supply the metropolis?—I recommend to take the power of the whole 30 feet.

96. But in your Report you have stated the supply at present of the metropolis to be about 13 feet from those three companies?—Yes.

1334. Why do you recommend the plan of taking the water either from the Verulam or from the Wandle, in preference to taking it from Richmond, provided there is filtration in both instances; provided both are filtered, why should you prefer taking it from the Wandle and the Verulam in preference to taking the water from the Thames at Richmond?—In the first place the appearance of the water of both the Wandle and Verulam was very tempting, being remarkably pure and transparent; and in the next place, as I have already stated, my plan saves both filtering and pumping.

1335. Would not the expense of the aqueduct more than equal the expense of filtering and pumping?—I think it is a more natural way of supplying the water than having recourse to artificial means, if you can get it.

1336. There is no objection to use artificial means to accomplish any object?—No.

1337. Do you not, in fact, by your plan, really buy the power in the shape of compensation to the mill owners?—We do.

1338. And that power is already possessed and in existence in the shape of steam-engines, by the present company?—Yes.

1339. Will you tell the Committee in your own way why we ought to prefer this at the expense of £1,200,000?—It would be a much more perfect scheme with respect to supplying the town, and much less objectionable to the people.

1340. In what less objectionable?—Because there are many strong objections to the use of Thames water.

1341. Without referring to the prejudice against the Thames water, what would be your recommendation, supposing there was no such prejudice?—*I should recommend my own plan as being the best.*

1342. Is it not infinitely more expensive?—Yes, more expensive, I dare say.

1343. Would it not increase very much the expense which we are now put to for water in the metropolis?—It might to a small extent; but the metropolis should certainly enjoy the purest water that can be procured.

1344. That would not be desirable?—Not if you can be well served without it, certainly.

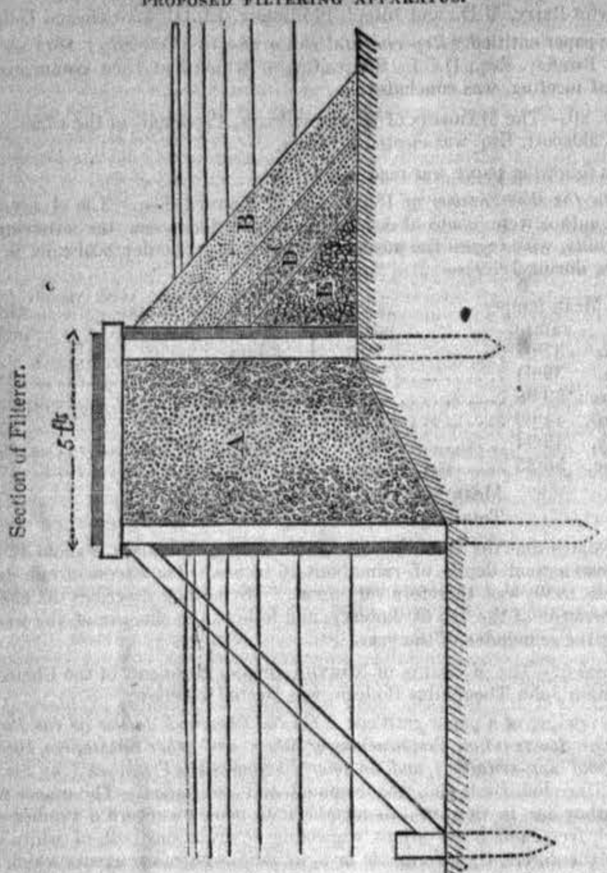
1345. Can you say it will not be as well supplied without that expense by taking it from Richmond?—I do not think so good a supply could be got at Richmond.

1346. If the companies would deliver the Richmond water filtered, would you say it was an objectionable supply?—Filtering takes out only what is mechanically suspended in the water, not what is dissolved.

From these extracts, we think there is ample testimony to show that a very copious supply of pure water may be obtained from that part of the Colne (called by Telford the Verulam), at Bushey Mills, for serving a large portion of the metropolis. Now it is near this spot that the promoters of the Company are carrying on their experiments, not intending at present to take the supply from the river itself, but from borings down to the springs, from which as the appearance of those already reached will show, in several parts of the Valley at a distance of nearly a mile from each other, the water rises to within 18 inches of the surface, and thus it is expected an ample quantity of water will be obtained, independent of the river Colne or Verulam, sufficient to supply the greater part of the metropolis without at all affecting the river. The Company are determined fairly to test the experiments for this purpose, and are now erecting a steam engine to ascertain what quantity of water can be really obtained. From the evidence of Mr. Telford already given as to the river coupled with the supply from borings, it appears beyond a doubt that an abundance of excellent water can be obtained without filtering or pumping. We think that the promoters are deserving of praise for the exertion which they are now making to bring the question to an issue, and if they can show that a large supply can be obtained sufficiently to provide water for at least three of the companies, it will be a great boon, not only to the public, but to the companies themselves, as we conceive it would be to the interest of all parties, that the old companies should take their supply from the new company, and thereby save the great and heavy expences of pumping and filtering which they are now obliged to adopt; as according to the evidence of Mr. Telford the new company will be able to supply the water in London at an elevation of 146 feet above Trinity datum, a height quite sufficient for the highest cistern of any part of London to be served by gravity.

We have extended our notice to a greater length than we originally intended, but the importance of the subject has led us on imperceptibly, we must therefore defer further notice of this interesting pamphlet, which affords abundance of materials for consideration—before we conclude we shall give the description of a proposed filtering apparatus designed by the author, and another which has been adopted in Switzerland.

PROPOSED FILTERING APPARATUS.



REFERENCE.

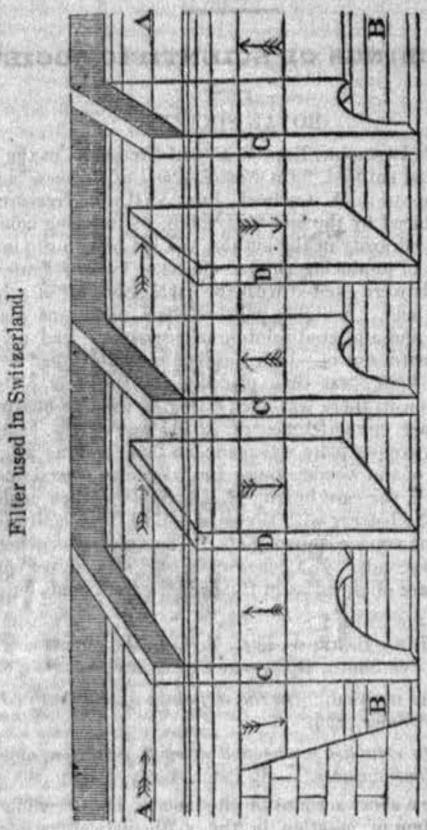
A, charcoal medium (the finest in the centre). B, fine sand. C, coarse sand. D, fine gravel, and pebbles. E, large gravel, and broken pottery.

The above is a sketch of a filtering apparatus, in which charcoal is proposed to be employed, both in a fine and coarse state, the finest being in the centre, as shown. In this case, lateral filtration by a head of water, is to be preferred to an extended surface over which the filtering materials are laid, and where the water percolates through, as in the first place, the materials, (the charcoal in particular,) will be more accessible at all times for cleansing, or renewing, when required. The charcoal, in fact, might be taken out and renewed, without interfering in the slightest way with the rest of the filtering materials, being separated from the gravel and sand, by the perforated planking, as shown in the sketch.

In the next place, the disposition of the sand, &c., the finest being placed outermost, at its natural slope of about 30° or 35°, would in a great measure supersede the necessity for having the surface scraped frequently, as done at the Chelsea water works, for there would be a *natural tendency*, in proportion as the outer layer of sand became loaded with the sediment and particles which it would arrest, for the sand to *slide down* to the base of the slope, where the sediment, &c., would accumulate, and from whence it might be easily removed. All that would be required in that case, would be to renew occasionally the outer layer of sand, which might be done with the greatest ease from the top of the filter-bank, without disturbing the remainder. It should be observed that where the sand comes in contact with the planking near the top of the structure, the planks should be laid with a close joint, to prevent the sand from being washed through.

Thirdly, the proposed method would be far less expensive, as regards the first cost, than the method of filtering by descent; as the construction of the frame-work would be entirely of timber, it could be put together by any carpenter at a trifling expense. The plan proposed would, in fact, combine the advantages of two distinct filters, acting in very different ways, with very little more trouble or expense, than would be involved in the construction of one only. With respect to the length of time during which the charcoal would retain its purifying qualities, it appears from Mr. Lowitz's experiments, before mentioned, that charcoal retained its antiputrescent properties *for a whole year;* and therefore, if the supply had to be renewed but once in that time, the expense would be but small. This must be, however, a matter of experiment; probably it might be found that by removing the charcoal from time to time, washing it well, and *exposing it to the light and air*, for a few days, it would part with whatever putrescent particles it had absorbed from the water, and might be made use of over again.

In order to facilitate the deposition and subsidence of the grosser impurities and sediment, previous to the water passing through the above filter-bank, a very simple and ingenious method might be employed, which has been put in practice with complete success in Switzerland, for purifying a stream of water, and which was described by Sir Henry Englefield, in the Philosophical Journal, so far back as 1804. It consists of a structure of timber or masonry, as shown in the perspective sketch below, where A A is the upper surface of the stream to be purified, and B B the bottom. The channel, or cut through which the water flows is divided into several chambers by the parallel partitions C, C, C, alternately rising above the surface level of the stream, and *open at the bottom*, while the intermediate partitions D, D, do not rise *within several feet* of the surface, and are continued to the bottom. It is obvious that the course of the water must be in the direction of the arrows, and in this repeated slow ascent and descent, all floating impurities will be left at the top, while the sediment and heavier impurities will subside to the bottom. The sediment, &c., may be easily removed and the apparatus cleansed, by sending down persons between the walls, and the operation would be facilitated by giving to the bottom of the cut or canal, the form of an inverted arch. The spaces between the partition walls might be partly filled with coarse filtering materials, such as broken pottery, or coarse gravel and pebbles, &c.



Illustrations of Indian Architecture from the Muhammadan Conquest downwards, by MARKHAM KITTOE, Esq. Calcutta: Thacker & Co., 1838. London: Allen.

We presume that Mr. Kittoe is not a member of the profession, but attached to the civil service in India, but he has produced a work which cannot but be valuable both to the student of this specific branch of architecture, and to those who are attached to the art in general. The buildings represented in the numbers before us, principally belong to the end of the seventeenth century, and their details are illustrated with an accuracy, which makes them equally useful and interesting. It is singular to trace in the buildings of Delhi or Agra some of the commonest ornaments of our own drawing rooms, and Mr. Kittoe's work presents variations of them which might be introduced with advantage here. Some of the trellis work in stone is particularly admirable, and would look extremely well in iron, or applied for grained ceilings, the variations of honeysuckle ornament are also well worthy of attention. These numbers are indeed a great accession to our stock of works on ornament, and Mr. Kittoe deserves the highest praise for producing a work so valuable in despite of all the difficulties of the Indian press. To us this work is also gratifying as it is a proof of our labours having penetrated there and been appreciated, and we cannot but recommend to architects and amateurs in the different parts of our empire to imitate Mr. Kittoe's excellent example, there is plenty of field in Malta, the Ionian Isles, Aden, our vast Indian empire, and during the several military expeditions. Much might be done by such observations to increase our stock of architectural works.

Ricauti's *Rustic Architecture.* London: Weale, 1840.

The first number of this work opens with the design and details of a cottage in the Elizabethan style, which, if it be a fair specimen of its successors, is highly promising. We are glad to see the taste which exists among our nobility for the erection of ornamental farm buildings, and publications of this nature are highly calculated to promote it. The example of the late Duke of Sutherland on his estates in Staffordshire, we trust, will have a lasting effect.

LITERARY NOTICE.

Mr. Jobbins has published a Map of the Environs of London, 30 miles round, at a scale of 3 miles to the inch, with the railways delineated, which for cheapness and completeness can vie with any.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

Jan. 16.—J. W. Lubbock, Esq., V. P. and Treasurer, in the Chair.

A paper was read entitled, " *On Nobili's Plate of Colours,*" in a letter from J. P. Gassiott, Esq., to J. W. Lubbock, Esq., V. P. and Treasurer.

The effect produced by the late Sig. Nobili, of inducing colours on a steel plate, excited the curiosity of the author, and led him to the invention of the following method of producing similar effects.—Two of Professor Daniell's large constant cells were excited with the usual solutions of sulphate of copper and sulphuric acid. A highly polished steel plate was placed in a porcelain soap-plate, and a filtered solution of acetate of lead poured upon it. A piece of card board, out of which the required figures had been previously cut with a sharp knife, was then placed upon the steel plate. Over the card, and resting on it, there was fixed a ring of wood, a quarter of an inch thick, and the inner circumference of which was of the same size as the figure. A convex copper plate was made, so that its outer edge might rest on the inner part of the wooden ring; and its centre placed near, but not in actual contact with, the card board. Connexion was then made by the positive electrode of the battery with the steel plate; the negative being placed in the centre of the copper convex plate. The figure was generally obtained in from 15 to 35 seconds. If a concave, instead of a convex plate be used, the same colours are obtained as in the former experiment, but in an inverse order.

Jan. 23.—Sir John Barrow, Bart. V. P., in the chair.

The Rev. John Pye Smith, D.D., was elected a Fellow.

A paper was read entitled, " *On the structure of Normal and Adventitious Bone.*" By Alfred Smee, Esq.

" *An attempt to establish a new and general Notation, applicable to the doctrine of Life Contingencies.*" By Peter Hardy, Esq.

After premising a short account of the labours of preceding writers, with reference to a system of notation in the mathematical consideration of life contingencies, the author enters at length into an exposition of the system of symbols which he has himself devised, together with the applications which they admit of in a variety of cases.

Jan. 30.—J. W. Lubbock, Esq., V.P. and Treasurer, in the Chair.

James Annesley, Esq., was elected a Fellow.

A paper was read, entitled " *Observations on Single Vision with two Eyes.*" By T. Wharton Jones, Esq.

The author animadverts on the doctrine which Mr. Wheatstone, in his paper on the Physiology of Binocular Vision, published in the Philosophical Transactions for 1838, p. 371, has advanced, in opposition to the received theory of single vision being dependent on the images of objects falling on corresponding points of the two retinæ. He maintains that, under these circumstances, the two impressions are not perceived by the mind at the same instant of time, but sometimes the one and sometimes the other. If one impression be much stronger than the other, the former predominates over, or even excludes, the other; but still the appearance resulting from the predominating image is, nevertheless, in some manner influenced by that which is not perceived. He supposes that there are compartments of the two retinæ, having certain limits, of which any one point or papilla of the one corresponds with any one point of the other, so that impressions on them are not perceived separately; and considers that this hypothesis, combined with the principle above stated, is required, in order to explain the phenomena in question.

Feb. 6.—J. W. Lubbock, Esq., V.P. in the Chair.

John Parkinson, Esq., and the Rev. Charles Pritchard, M.A., were elected Fellows.

A paper was read, entitled " *Observations on the Blood-corpuscles of certain species of the genus Cervus.*" By George Gulliver, Esq.

Feb. 13.—The Marquis of Northampton, President, in the Chair.

Martin Barry, M.D., and Joseph Phillimore, LL.D., were elected Fellows.

The paper entitled "*Experimental Researches in Electricity; 16th series:*" by M. Faraday, Esq., D.C.L., the reading of which had been commenced at the last meeting, was concluded.

Feb. 20.—The Marquis of Northampton, President, in the Chair.

J. Caldecott, Esq. was elected a Fellow.

The following paper was read :—

" *On the Wet Summer of* 1839." By L. Howard, Esq. The observations of the author were made at Ackworth, in Yorkshire; and the following are his results, with regard the mean temperature and the depth of rain, in each month, during 1839 :—

	Mean temperature.	rain in inches.		Mean temperature,	rain in inches.
Jan.	37·04°	1·13	July,	59·30°	5·13
Feb.	39·64	2·14	Aug.	58·09	2·94
March,	39·08	3·21	Sept.	54·49	3·43
April,	44·09	0·58	Oct.	48·39	3·40
May,	49·94	0·38	Nov.	43·14	4·54
June,	56·35	4·89	Dec.	37·29	1·85

Mean temperature of the year 47·24°.
Total depth of rain, in 1839, 33·62 inches.

He states that the climatic mean temperature of the place is about 47°, and the mean annual depth of rain about 26 inches. The excess of rain during the year 1839, was, therefore very great. The author describes the effect of the hurricane of the 7th of January, and follows the changes of the weather during the remainder of the year.

March 5.—The Marquis of Northampton, President, in the Chair.

Captain John Theophilus Boileau, was elected a Fellow.

The reading of a paper entitled, " *On the Chemical Action of the Rays of the Solar Spectrum on Preparations of Silver and other Substances, both metallic and non-metallic; and on some Photographic Processes,*" by Sir John F. W. Herschel, Bart. &c., was resumed and concluded.—The object which the author has in view in this memoir is to place on record a number of insulated facts and observations respecting the relations both of white light, and of the differently refrangible rays, to various chemical agents which have offered themselves to his notice in the course of his photographic experiments, suggested by the announcement of M. Daguerre's discovery. After recapitulating the heads of his paper on this subject, which was read to the Society on the 14th of March 1839, he remarks, that one of the most important branches of the inquiry, in point of practical utility, is into the best means of obtaining the exact reproduction of indefinitely multiplied fac-similes of an original photograph, by which alone the publication of originals may be accomplished; and for which purpose the use of paper, or other similar materials, appears to be essentially requisite. In order to avoid circumlocution, the author employs the terms *positive* and *negative* to express, respectively, pictures in which the lights and shades are the same as in nature, or as in the original model, and in which they are the opposite; that is, light representing shade; and shade, light. The terms *direct* and *reverse* are also used to express pictures in which objects appear, as regards right and left, the same as in the original, and the contrary. In respect to photographic publication, the employment of a camera picture avoids the difficulty of a double transfer, which has been found to be a great obstacle to success in the photographic copying of engravings or drawings. The principal objects of inquiry to which the author has directed his attention in the present paper, are the following.

1. The means of fixing photographs; the comparative merits of different chemical agents for effecting which, such as hyposulphite of soda, hydriodite of potass, ferrocyanate of potass, &c., he discusses at some length; and he notices some remarkable properties, in this respect, of a peculiar agent which he has discovered.

2. The means of taking photographic copies and transfers. The author lays great stress on the necessity, for this purpose, of preserving, during the operation, the closest contact of the photographic paper used with the original to be copied.

3. The preparation of photographic paper. Various experiments are detailed, made with the view of discovering modes of increasing the sensitiveness of the paper to the action of light; and particularly of those combinations of chemical substances which applied either in succession or in combination, prepare it for that action. The operation of the oxide of lead in its saline combinations as a mordant is studied; and the influence which the particular kind of paper used has on the result, is also examined; and various practical rules are deduced from these experiments. The author describes a method of precipitating on glass a coating possessing photographic properties, and thereby of accomplishing a new and curious extension of the art of photography. He observes, that this method of coating glass with films of precipited argentine, or other compounds, affords the only effectual means of studying their habitudes on exposure to light, and of estimating their degree of sensibility, and other particulars of their deportment under the influence of reagents. After stating the result of his trials with the iodide, chloride, and bromide of silver, he suggests that trials should be made with the fluoride,

from which, if it be found to be decomposed by light, the corrosion of the glass, and consequently an etching, might possibly be obtained, by the liberation of fluorine. As it is known that light reduces the salts of gold and of platinum, as well as those of silver, the author was induced to make many experiments on the chlorides of these metals, in reference to the objects of photography; the details of which experiments are given. A remarkable property of hydriodic salts, applied, under certain circumstances, to exalt the deoxidating action of light, and even to call into evidence that action, when it did not before exist, or else was masked, is then described.

4. The chemical analysis of the solar spectrum forms the subject of the next section of his paper. It has long been known that rays of different colours and refrangibilities exert very different degrees of energy in effecting chemical changes; and that those occupying the violet end of the spectrum possess the greatest deoxidating powers. But the author finds that these chemical energies are distributed throughout the whole of the spectrum; that they are not a mere function of the refrangibility, but stand in relation to physical qualities of another kind, both of the ray and of the analyzing medium; and that this relation is by no means the same as the one which determines the absorptive action of the medium on the colorific rays. His experiments also show that there is a third set of relations concerned in this action, and most materially influencing both the amount and the character of the chemical action on each point of the spectrum; namely, those depending on the physical qualities of the substance on which the rays are received, and whose changes indicate and measure their action. The author endeavoured to detect the existence of inactive spaces in the chemical spectrum, analogous to the dark lines in the luminous one; but without any marked success. The attempt, however, revealed several curious facts. The maximum of action on the most ordinary description of photographic paper, namely, that prepared with common salt, was found to be, not beyond the violet, but about the confines of the blue and green, near the situation of the ray F in Fraunhofer's scale: and the visible termination of the violet rays nearly bisected the photographic image impressed on the paper: in the visible violet rays there occurred a sort of minimum of action, about one-third of the distance from Fraunhofer's ray H, towards G; the whole of the red, up to about Fraunhofer's line C appears to be inactive; and lastly, the orange-red rays communicate to the paper a brick-red tint, passing into green and dark blue. Hence are deduced, first, the absolute necessity of perfect achromaticity in the object-glass of a photographic camera: and secondly, the possibility of the future production of naturally coloured photographs.

5. The extension of the *visible* prismatic spectrum beyond the space ordinarily assigned to it, is stated as one of the results of these researches; the author having discovered that beyond the extreme violet rays there exist luminous rays affecting the eyes with a sensation, not of violet, or of any other of the recognized prismatic hues, but of a colour which may be called *lavender-grey*, and exerting a powerful deoxidating action.

6. Chemical properties of the red end of the spectrum. The rays occupying this part of the spectrum were found to exert an action of an opposite nature to that of the blue, violet, and lavender rays. When the red rays act on prepared paper in conjunction with the diffused light of the sky, the discolourating influence of the latter is suspended, and the paper remains white; but if the paper has been already discoloured by ordinary light, the red rays change its actual colour to a bright red.

7. The combined action of rays of different degrees of refrangibility is next investigated; and the author inquires more particularly into the effects of the combined action of a red ray with any other single ray in the spectrum; whether any, and what differences exist between the joint, and the successive action of rays of any two different and definite refrangibilities; and whether this action be capable, or not, of producing effects, which neither of them, acting alone, would be competent to produce. The result was that, although the previous action of the less refrangible rays does not appear to modify the subsequent effects produced by the more refrangible; yet the converse of this proposition does not obtain, and the simultaneous action of both produces photographic effects very different from those which either of them, acting separately are capable of producing.

8. In the next section, the chemical action of the solar spectrum is traced much beyond the extreme red rays, and the red rays themselves are shown to exercise, under certain circumstances a blackening or deoxidating power.

9. The author then enters into a speculation suggested by some indications which seem to have been afforded of an absorptive action in the sun's atmosphere; of a difference in the chemical agencies of those rays which issue from the central parts of his disc, and those which, emanating from its borders, have undergone the absorptive action of a much greater depth of his atmosphere; and consequently of the existence of an absorptive solar atmosphere extending beyond the luminous one.

10. An account is next given of the effect of the spectrum on certain vegetable colours, as determined by a series of experiments, which the author has commenced, but in which the unfavourable state of the weather has, as yet, prevented him from making much progress.

11. The whitening power of the several rays of the spectrum under the influence of hydriodic sals, on paper variously prepared, and previously darkened by the action of solar light. The singular property belonging to the hydriodate of potash of rendering darkened photographic paper susceptible of being whitened by further exposure to light, is here analyzed, and shown to afford a series of new relations among the different parts of the spectrum, with respect to their chemical actions.

12. The Analysis of the Chemical Rays of the Spectrum by absorbent media, which forms the subject of the next section, opens a singularly wide field of inquiry; and the author describes a variety of remarkable phenomena which have presented themselves in the course of his experiments on this subject. They prove that the photographic properties of coloured media do not conform to their colorific character: the laws of their absorptive action as exerted on the chemical, being different and independent of those on the luminous rays: instances are given of the absence of any darkening effect in green and other rays of the more refrangible kind, which yet produce considerable illumination on the paper that receives them.

13. The exalting and depressing power exercised by certain media, under peculiar circumstances of solar light, on the intensity of its chemical action. This branch of the inquiry was suggested by the fact, noticed by the author in his former communication, that the darkening power of the solar rays was considerably increased by the interposition of a plate of glass in close contact with the photographic paper. The influence of various other media, superposed on prepared paper, was ascertained by experiment, and the results are recorded in a tabular form.

14. The paper concludes with the description of an *Actinograph*, or self-registering photometer for meteorological purposes: its objects being to obtain a permanent and self-comparable register and measure, first, of the momentary amount of general illumination in the visible hemisphere, which constitutes day-light; and secondly, of the intensity, duration, and interruption of actual sunshine, or, when the sun is not visible, of that point in the clouded sky behind which the sun is situated. In a postscript, dated March 3rd, 1840, the author states that he has discovered a process by which the colorific rays in the solar spectrum are made to affect a surface properly prepared for that purpose, so as to form what may be called a *thermograph* of the spectrum; in which the intensity of the thermic ray of any given refrangibility is indicated by the degree of whiteness produced on a black ground, by the action of the ray at the points where it is received at that surface, the most remarkable result of which is the insulation of *heat-spots* or thermic images of the sun quite apart from the great body of the thermic spectrum. Thus the whole extent over which prismatic dispersion scatters the sun's rays, including the calorific effect of the least, and the chemical agency of the most refrangible, is considerably more than twice as great as the Newtonian coloured spectrum. In a second note, communicated March 12, 1840, the author describes his process for rendering visible the thermic spectrum, which consists in smoking one side of very thin white paper till it is completely blackened, exposing the white surface to the spectrum and washing it over with alcohol. The thermic rays, by drying the points on which they impinge more rapidly than the rest of the surface, trace out their extent and the law of their distribution by a whiteness so induced on the general blackness which the whole surface acquires by the absorption of the liquid into the pores of the paper. He also explains a method by which the impression thus made, and which is only transient, can be rendered permanent. This method of observation is then applied to the further examination of various points connected with the distribution of the thermic rays, the transcalescence of particular media, and the polarization of radiant heat (which is easily rendered sensible by this method), &c. The reality of more or less insulated spots of heat distributed at very nearly equal intervals along the axis of the spectrum (and of which the origin is *probably* to be sought in the flint glass prism used—but *possibly* in atmospheric absorption) is established. Of these spots, two of an oval form, are situated, the one nearly at, and the other some distance beyond the extreme red end of the spectrum, and are less distinctly insulated; two, perfectly round and well insulated, at greater distances in the same direction; and one, very feeble and less satisfactorily made out, at no less a distance beyond the extreme red than 422 parts of a scale in which the whole extent of the Newtonian coloured spectrum occupies 539.

A paper was also read entitled, "*Remarks on the Theory of the Dispersion of Light, as connected with Polarization.*" By the Rev. Baden Powell, M. A. Since the publication of a former letter on the same subject, the author has been led to review the theory in connexion with the valuable illustrations given by Mr. Lubbock of the views of Fresnel; and points out, in the present supplement, in what manner the conclusions in that paper will be affected by these considerations.

A paper was also read, entitled, "*Further Particulars of the Fall of the Cold Bokkeveld Meteorite.*" By Thomas Maclear, Esq., F.R.S., in a letter to Sir J. F. W. Herschel, Bart.—This communication, which is supplementary to the one already made to the Society by Mr. Maclear, contains reports, supported by affidavits, of the circumstances attending the fall of a meteoric mass in a valley near the Cape of Good Hope. The attention of the witnesses had been excited by a loud explosion which took place in the air, previous to the descent of the aerolite, and which was attended by a blue stream of smoke, extending from north to west. Some of the fragments which had been seen to fall, and which had penetrated into the earth, were picked up by the witnesses. One of them falling on grass caused it to smoke: and was too hot to admit of being touched. The mass which was sent to England by H.M.S. *Scout*, weighed, when first picked up, four pounds. The paper is accompanied by a map of the district, showing the course of the aerolite.

A paper was also read, entitled, "*An account of the Shooting Stars of* 1095 *and* 1243." By Sir Francis Palgrave, K.H.—The author gives citations from several chronicles of the middle ages, descriptive of the remarkable appearance of shooting stars which occurred on the 4th of April, 1095, on the testimony of independent witnesses both in France and England. One of them describes them as "falling like a shower of rain from heaven upon the earth:" and in another case, a bystander, having noted the spot where the aerolite fell, "cast water upon it, which was raised in steam, with a great noise of boiling." The Chronicle of Rheims describes the appearance as if all the stars in heaven were driven, like dust, before the wind. A distinct account of the shooting stars of July 26th, 1293, is given by Matthew Paris.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

Monday, 30th March, 1840, W. R. Hamilton, Esq. in the chair. George Gutch, Esq. Fellow, presented 10 guineas for the purchase of books.

The following papers were read :—

On Garden Walls, by J. B. Watson, Fellow.

A paper from Mr. Jenkins "*on Talacre Stone*."

I have the pleasure of offering to your notice a stone quarry in North Wales, whose produce is now importing into London, two cargoes having already arrived; and, unless I am much mistaken, the introduction of this stone to the British architects will prove a valuable boon. The quarries are situated on the coast of Flintshire, within a mile of the point of Air, at the mouth of the estuary of the Dee, and adjoining the grounds of Talacre Hall, the seat of Sir Edward Mostyn, Bart.

The mineralogical character of this stone is that of silicious sand-stone, with an argillo-silicious cement. It is of great density, a cubic foot weighing 150¼ lbs., is worked with great ease, and being remarkably free from hard untractable veins and soft places, is capable of a very smooth surface, a fine arris, and the most delicate carving. The closeness of its texture and fineness of its grain, render it very desirable for external work in a large city, as it prevents the soot from adhering to it, and thus clogging up the mouldings and carvings, reducing them to an undistinguishable mass of blackness, a fault justly complained of in the Bath and Portland stones.

For landings and steps, the Talacre stone far excels the very best kinds of Yorkshire stone, as it is superior in strength, and not liable to scale in the unsightly manner that so frequently destroys the appearance of the finest pavements of Yorkshire stone, as may be seen near the Post Office, and in the Temple; and as the quarries are now in the possession of a London company (the Talacre Coal and Iron Company,) an abundant supply of large sized stone may be expected.

Its colour is very uniform, and, to my taste, has a beautiful *tone*, which eminently fits it for interior finishings, especially in the Gothic style.

Its durability may be seen in the shrine of St. Winifred's well, at Holywell, in Flintshire, which was constructed of this stone in the 15th century, and, though exposed to the humidity of the air, incident to the neighbourhood of mountains and an arm of the sea, as well as to the clouds of sulphurous smoke from the numerous works on the stream issuing from that celebrated spring, yet still preserves its rich and delicate carvings in a very perfect state. Many other ancient buildings in the neighbourhood have been constructed or ornamented with this stone, as the ancient mansion in the village of Llanasa, with its curious carved porch, erected in 1642, the carvings and ashlar of which are still very perfect, the quoins of Rhyddlan and Denbigh Castles, built the latter end of the 13th century; and among modern buildings, Talacre Hall, the seat of Sir Edward Mostyn, Bart., the masonry of which is the admiration of all. I may mention that the chimney pieces of this mansion, in the Gothic style, are carved in this stone, and have a very beautiful effect.

The following is the result of an experiment made on the comparative strength of the Talacre stone with best Yorkshire.

A piece of Talacre stone, 2 ft. 6½ in. long, 3¾ in. wide, and 2 in. thick, bore, for several minutes, a weight of	4	2	1
Best Yorkshire of the same size broke immediately with a pressure of	4	0	11

I may add that, from the proximity of the quarries to the new harbour of Port Talacre, this stone can be brought to London at a price little, if at all, exceeding that of Yorkshire stone.

Mr. Donaldson read a paper "*On various extraordinary tombs, recently brought to light at the ancient city of Cære, and described in a work of much learning and research, forwarded to the Society by its author, the Cavaliere Canina, an Honorary and Corresponding Member.*

About half way on the road between Rome and Cività Vecchia, is the village of Cervetri, or Cerveteri, the site of the ancient Cære, where some judicious excavations have brought to light a tomb, which seems at once to prove the affinity of the ancient inhabitants of these parts with the Greeks, and affords a confirmation of the supposition of their common origin, derived from other discoveries of an analogous nature. Immediately contiguous to Cervetri is a platform of considerable extent, on which was doubtless the ancient Cære, surrounded once, it is presumed, with walls. Within a short distance of the precinct marked by the supposed line of wall are a number of tombs, one of which is that now about to be explained. It evidently bears the proofs of two distinct epochs of construction, as the original edifice, which forms the centre, consisted of a solitary chamber in the body of a circular mass surmounted by a mound of earth. This was subsequently enlarged by another ring of solid masonry, containing various cells, also surmounted by a larger mound of earth. This addition so effectually closed from observation the inner chamber, that it has remained, until the present period, undespoiled of its precious relics; while the outer chambers have been robbed of every object that they once contained, from their entrances being immediately exposed to view. The original tomb consists of a circular mass about 82 feet in diameter, having apparently an outer ring of solid masonry, and a central pillar of construction, which ran up to the top, and served to support the mound of earth, which formed the conical part of the tumulus; and probably it was surmounted externally by a pedestal, on the top of which was a statue, or some object allusive to the deceased. The sepulchral chambers consisted of an outer gallery, about 30 feet long, and 5 ft. 8 in. wide, and 11 ft. 2 in. high, at the further end of which were two oval-formed chambers, about 11 ft. 6 in. long, by 9 ft. wide, on the right and left, rudely worked out of the solid mass. At the extremity of the outer gallery is a wall with a small aperture in it, opening into another gallery about two-thirds the length of the first one, or 20 feet, and 4 ft. 3 in. wide. The walls of the galleries seem to be formed of a rude solid perpendicular construction, about 5 feet high, above which are three overhanging courses, with horizontal joints, or beds, forming an inclined roof on each side. Another uppermost course is perpendicular, and leaves a kind of square channel, about 18 inches wide and 15 inches high, running the whole length. The walls of the oval chambers seem to be worked out of the rude solid mass, and do not present the appearance of any regular courses of stone. There were smaller chambers in the periphery of the outer construction, formed in a similar manner, and when it was deemed desirable, at a subsequent period, to procure greater accommodation for the family, it seems to have been effected by enlarging the circumference and extending the smaller chambers. But it is remarkable that the large gallery or chamber in the original mass was not carried out, as though there was the wish to hold it sacred as the deposit of the chief of the family, and to secure it from intrusion by closing up its entrance. It will be seen that the construction of the walls of the galleries is similar to that of the subterraneous chamber at Mycenæ, commonly called the Treasury of Atreus, or Tomb of Agamemnon, and illustrated in the supplementary volume to Stuart's Athens. The courses are horizontal, and gathering over each other gradually towards the apex of the roof, and cut away so as to give the inner face a concave appearance. But another remarkable instance of this peculiar construction of ancient art, exists at Rome in the Mamertine Prison, the lower cell of which was once evidently built in the same manner, the upper part having subsequently been cut off, and the arch surmounting it constructed as a regular arch with concentric courses. Mr. Donaldson then described the various objects which were found in this tomb. In the first gallery next the door was a brazier placed on an iron tripod, and close to it a bronze censer for perfumes, and next to that another brazier. Further in was a four-wheeled car, upon which was borne the corpse laid on the bronze bed; and there remained many fragments of the wood of which it was formed, and of the bronze with which it was ornamented. Near the entrance to the right hand oval chamber was a bronze bedstead, on which lay the body of the defunct, evidenced from the bones on the floor and traces of stains produced by the decomposition of the flesh. There were two small iron altars, one at the head and the other at the foot of the bedstead, and about two dozen small earthenware figures on the floor round the three outer sides of the bedstead, several shields, a bundle of arrows; and these, with some cuirasses, which once hung on the walls, prove this to have been the sepulchral chamber of a warrior. In the channel in the roof were suspended from nails some bronze vases and dishes. The inner gallery seems to have been appropriated as the sepulchral chamber of a female. When first discovered, it was found to be encumbered with the ruins of one of the side walls, which had fallen in; but upon removing the rubbish and dirt, various articles in gold and silver were found among the remains of the body, which had been deposited at the further end. A small silver bucket, and a cup without handles, various bronze cups and vases, proper for scents and perfumes, were also discovered. The two oval chambers to the right and left of the outer gallery, were evidently of a subsequent period, and were formed in a very rude and rough manner, as though added with great haste. The chamber on the left contained various cups and other objects of bronze, and in that to the right were found numerous little terra-cotta figures similar to those in the outer gallery, near the funeral bedstead, and some earthen vases, in one of which were deposited burnt bones and ashes, remains, doubtless, of some member of the same family, and, it is to be inferred, of a period somewhat subsequent to the outer chamber, as in that the body had not been burnt, a practice of later introduction. Canina is of opinion, from an observation of the various bronze objects found in these tombs, and engraved with representations of combats and huntings of animals, and none of which represented the events that occurred at Troy, that this tomb must have been erected before this important period of Greek history, a supposition which gains strength, from the peculiar form of the Greek characters of the inscriptions. It may therefore be concluded, that this tumulus must be about 3,000 years old, and was erected during the period that the Pelasgi held possession of the country.

April 27.—The Marquis of Northampton in the Chair.

Signor Gasparo Fossati, architect to the Emperor of Russia, was elected an Honorary and Corresponding Member.

Some Roman remains from Watling Street, were exhibited by Mr. Fowler

A paper was read, "*On the Classification of Egyptian Architecture*," by Mr. George Alexander, the tendency of which was to show, that many buildings, usually attributed to the earlier Egyptian or Pharaonic dynasties, were in reality much more recent, being erected during the Ptolemaic and Roman rule in Egypt; which gave rise to some observations by Mr. Hamilton and Sir Gardner Wilkinson, who were present.

A paper was also read, entitled,

"*Remarks on the question raised by Sir Gardnor Wilkinson respecting the origin of the Vertical Line in Architecture, and the Return to the Horizontal Line after the "Revival.*" By George Godwin, jun., F.R.S. & S.A.*

At a recent meeting of the Institute of Architects, Sir Gardnor Wilkinson laid before the members some pertinent remarks, concerning the appearance of the vertical line in architecture at an earlier period than is generally ascribed to its introduction—remarks which, while they prove the acuteness of his observation, and cannot but lead to the exercise of thought on the part of those who are engaged in the study of architectural history, serve as evidence of the writer's interest in our proceedings, and entitle him to our thanks. I should be sorry, then, if they were allowed to pass unnoticed, and am tempted, in order that this may not be the case, to offer at once a few observations on the subject. I feel some diffidence, I must confess, in coming before you on this occasion, because there are many others present much better qualified to respond satisfactorily to the inquiry; indeed, I should not have done so, could I have been certain that any individual would have offered himself for the task. Experience, however, teaching that the only certain way to have one's wants and wishes fulfilled, is to bestir oneself in carrying them out personally, I have stepped into the breach, and must plead the goodness of the intention as an excuse.

The bearing of Sir Gardnor Wilkinson's general argument was to the effect that the vertical line, admitted to be the principal feature distinguishing Gothic, or what has been termed *Church Architecture* from the Greek style, whereof the predominance of horizontal lines is a characteristic—originated at a much earlier date than the style it now distinguishes, and is to be found extensively in the ruins of ancient Rome. Further, that after the revival of the classic style in Italy, although the vertical line was still used throughout the *churches* of Christian Rome, we do not perceive it in the numerous and splendid palazzi which arose there and in other parts of Italy, but that the horizontal line is in them again made predominant. And the question he then put was, "what was the origin of the vertical style in ancient Rome, and the return to the horizontal style in the palaces of modern Italy."

What Sir Gardnor Wilkinson means by the vertical line in ancient Rome, and the appearance which it offered, are very clearly pointed out in the following sentence extracted from his paper:—

"In an arch of triumph, a Roman composition, though the mouldings and many other details are borrowed from the Greek, the vertical line commences with the pedestal of the columns appended to its side, and extending upwards with the column, breaks through the entablature, which it obliges to come forward to carry out and mark its direction, requires a projection of the attic to correspond with the capital above the cornice, and terminates in a statue: thus continuing it uninterruptedly from the base to the summit of the building."

Now it appears to me, that this mode of arrangement may be ascribed simply to the introduction of the ARCH as a chief feature in construction, and the decline, if not original want, of pure taste on the part of the Roman people. In Greece, and in the earlier sacred edifices of Rome, built before the introduction of the arch, and in imitation of those of Greece, columns bore the beams of wood or blocks of stone forming the upper part of the building, and were a constituent portion of the fabric. When, however, it became necessary to cover in larger spaces than could be conveniently spanned by single beams or blocks reaching from pillar to pillar, and the principle of the arch became generally understood and acted upon, a continued wall from which the arch might spring became requisite, and took the place of columns. The Romans, however, who, if I may venture to say it, had little real appreciation of harmony and fitness, (with a love of which the Greeks as a people were thoroughly imbued,) could not consent to abandon columns, but used them in the shape of accessories in nearly all structures the destination of which would allow of their introduction. They were placed against the faces of buildings—attached to but not made a portion of them. Probably where a great projection was not advisable, the height of the columns (as by that of course the diameter must have been regulated,) was lessened, and a pedestal (*column's foot*) was used to raise them to the required elevation. Something to bind the upper part of the column to the building was, however, requisite, and the entablature, then surrounding the structure itself, may have been brought out for that purpose over each of the columns. These, of themselves, namely columns bearing nothing, performing no office, but simply standing before a building with which they seemed to have little connexion, must have failed to give pleasure even to the least educated minds; offering, however, as they did, a convenient plinth for vases, or sculptured figures, these were found in some degree to lessen the objection, and therefore it is not surprising that they were usually thus terminated, sometimes with and sometimes without, the intervention of a similar projection of the attic under the figure.

In examining a Roman arch of triumph, that of Septimus Severus for instance, as well as many others, the probability of this position becomes very striking. And throughout the buildings of Rome so long as columnar decorations were employed, this mode of arrangement seems to have been almost necessarily followed.

Sir Gardnor Wilkinson says that wherever deviation from Greek models was allowable, the vertical line constantly predominates, "and to such an extent, that even a Greek entablature is sacrificed to this their favourite sentiment, being broken up into detached parts and compelled to project and recede, in order to allow the vertical line to pass continuously through it to the summit of the building."

This seems to me, but I mention it with great deference, to invest the use of the vertical line by the Romans with a little too much importance. I am compelled to think, a desire for its use was not the cause of the introduction of breaks and recesses, but that its own appearance, as well as these breaks, were the accidental effect of the employment of adventitious columnar decoration in situations where considerations of expense or convenience prevented the use of a continuous entablature. Although it is probable that when once the vertical line was strongly marked in a façade, the natural love of harmony in mind which finds annoyance in the constant recurrence of discordant lines, would induce subsequent arrangements in unison with the prevailing character.

Immediately on the *revival*, we find columnar decoration indulged in, even with less restraint from good taste than before, producing in nearly all cases, whether in Italy, France, or England, the predominance of the vertical line. The cupola of the church of *Santa Maria del Fiore*, at Florence, by Brunelleschi, and the church dedicated to St. Francis at Rimini, by Alberti, both in the 15th century—the Basilica of Vicenza by Palladio, in the 16th—the principal façade of St. Peter's at Rome, by Maderno, at the beginning of the 17th—and the hospital of the *Invalides* in Paris, by Mansart, in the 18th—may all be referred to as instances. In our own metropolis, Inigo Jones, at the Banquetting House, Whitehall, and Wren at St. Paul's Cathedral, afford us examples: and to bring the duration of this mode of arrangement up to the present time, I may mention Messrs. Cockerell and Richardson's design for the Exchange, submitted to the Gresham Committee, in the chief front of which it strikingly prevails.

Returning, however, for a moment to Italy at the period of the revival, we find that works of the same artists wherein adventitious columnar decoration was not introduced, display the horizontal line predominant, witness for example the façade of the Pitti Palace at Florence, by Brunelleschi, and the greater number of the numerous palatial residences at Rome and elsewhere, which render Italy as eminent for the possession of modern works of architectural skill as she is for the remains of her ancient glories. This predominance of the horizontal line however was not quite universal. In the Palace of the Chancery at Rome, for example, the vertical line is nearly continuous throughout the façade, although the entablature is unbroken. I will not pretend now to enter upon an examination of the feeling and motive of the architecture of this period, although it is a subject full of interest, and well worthy of what it has not yet sufficiently received, namely, investigation and analysis: should what has been said chance to lead to this very desirable result on the part of a qualified investigator, the profession will be greatly indebted to Sir Gardnor Wilkinson.

New Mouth of the Vistula.—In consequence of the early breaking up of the ice in the Vistula, and the flood occasioned by the late heavy rains, the river was choked up a mile and a half above the city of Dantzic, whence it takes its course to the westward. The left bank of the river is here bounded by a dyke, which protects the fruitful low country behind it; the right bank is, however, without any such artificial protection, because its immediate neighbourhood consists of unfruitful sand land, and of a road of sand-hills or downs, for a distance of several German miles, which separates the river from the sea in such a decided manner, that it never appeared possible to any one that from that side any danger was to be apprehended from the water in the Vistula. But it happened on the night of the 31st of January, when it was expected that every moment the water would run over the dykes on the left bank of the river, and produce a most dreadful inundation, that the stream, encumbered with heavy masses of ice, took its course over the right bank, and attained the sand hills. These being from forty to sixty feet high, stopped the water, but the current undermined them just at the place where those hills merely consist of loose sand, and are the narrowest. As soon as they gave way, the accumulated mass of water and the heavy ice found their way through this new opening with indescribable force, and made a broad and deep channel into the sea. To stop this new natural mouth is impossible, and if it could be done, no one would feel inclined to do it. About thirty years ago, the plan was proposed by members of the government to form exactly the new mouth for the river which has just been made by a natural cause. Thus a great expence has been saved, and a great benefit operated at the same time, by this occurrence. As regards the influence which this event may have on the communication of the town of Dantzic with the Port Fairwater, and also with Poland and the interior of the country, there is not the least ground to apprehend any interruption. We by no means lose the navigableness of the old Vistula, which, henceforward as before, will bring the Polish barges and the timber transports to our town. Its depth is likewise sufficient in its whole length to bear vessels of the same magnitude as before. Neither does the occurrence make any change whatever in the communication of that town with the sea-port.—*Morning Chronicle.*

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* We are glad to learn that the *Société Libre des Beaux Arts*, at their last annual meeting, awarded a silver medal to Mr. Godwin, as author of "The Churches of London."—EDITOR OF C. E. & A. JOURNAL.

EARL DE GREY'S CONVERZATIONE.

On Thursday evening the 21st ult., Earl De Grey opened his house in St. James's Square, for the reception of the Royal Institute of British Architects, of which Society his Lordship is the President. In addition to the members of the Institute, the splendid suite of apartments was crowded by a numerous and brilliant assembly of the patrons and professors of every branch of the arts and sciences, among whom we noticed the Marquis of Lansdowne, Lord Stuart de Rothesay, Lord Bughersh, Sir Edward Cust, Mr. Gally Knight, and Mr. Rogers, Sir Martin Shee, Sir Richard Westmacott, Sir Francis Chantry, Sir David Wilkie, Mr. Martin, Mr. Copley Fielding, Sir Gardner Wilkinson, Sir Henry Ellis, Sir Frederick Madden, Mr. Walker, Mr. Brunel, Mr. Babbage, Mr. Allan Cunningham, &c. &c. Her Grace the Duchess of Northumberland and a select party of ladies of rank were also present. The attention of the visitors was attracted by a display of works of art from the portfolios of Mr. Stanfield, Mr. Joseph Nash, and other artists of eminence, and by some beautiful specimens of the Daguerrotype and electrotype.

MR. WALKER'S CONVERZATIONE.

On Wednesday evening the 27th ultimo, Mr. Walker, the President of the Institution of Civil Engineers, invited a large number of scientific gentlemen to a converzationé held at his house in Great George-street, the rooms were crowded at an early hour of the evening, we have not witnessed so large an assembly of the scientific and literati during the season. The company were entertained by a display of numerous works of art, drawings and models of new inventions, a few of which we shall just take a glance at. The portfolios of drawings by Scannell, Tomkins, Landseer, and Lake Price were much admired, so also the elaborate work on the Alhambra by Owen Jones. There was exhibited an excellent specimen of electrotype taken from an engraving of Byron, the original engraving was shown from which the electrotype was produced, the first is in relief, and for the purpose of taking off impressions, a second electrotype is obliged to be taken off from the first, which brings this last impression to the same appearance as the original plate; there were also shown two impressions, one taken from the original plate, and the other from the second electrotype, both of them were so much alike, that it was with difficulty any difference could be detected.—There was a fine representation in stained glass of Mary Queen of Scots and Knox, by Messrs. Hoadley and Oldfield.—In the model room was exhibited a beautiful set of 8 models of Mr. Brunel's block machinery at Portsmouth, showing the different operations the block passed through from the square block of wood to its completion.—Mr. Rennie's trapeziod paddle-wheel attracted considerable notice, likewise the beautiful models of Mr. Samuel Seaward's marine atmospheric steam-engines, also his slide valves by which the eduction valve is opened before the induction valve, thereby allowing a better and more rapid escape of the steam to the condenser, and producing a better vacuum; his brine detector which exhibits the quantity of salt with which water in marine boilers is impregnated, is of great advantage to the engineer, by the aid of which he is enabled to judge the proper times it is necessary to *blow off*, for the purpose of cleansing the boilers of the salts which are deposited at the bottom, which if not attended to, very soon destroys the metal.—Another very ingenious model was that of Mr. Davison's refrigerator, lately constructed at Messrs. Truman's brewery, a vertical cylinder which contains several tubes, is filled with a stream of cold water, constantly flowing through it, which surrounds the tubes; there is also a blast of cold air forced through the interior of the tubes by the aid of a fan blower—the hot liquor is admitted into an open chamber on the top of the cylinder and allowed to gradually overflow the tubes which project above the bottom of the open chamber, and trickle down the interior side of the tubes, thus it is cooled by the combined operation of cold water coming in contact with the outside of the tubes, and the cold blast up the centre of their interior, by the time the hot liquor has arrived at the bottom, it is sufficiently cooled to be conveyed into the working tuns.—There was a model of Messrs. Maudslays and Field's double cylinder steam-engine, described in a late number of the Journal.—Mr. Milne's hydrostatic gas regulator, by the aid of which the lights are always kept at one height and intensity.—The patent omnibus, if we may judge correctly by the model, appears to be a cumbersome machine, and likely to monopolize the whole of the streets in the city, if many are to be introduced.—There were likewise several models of machines and apparatus connected with railways and steam navigation, by Mr. Curtis, Mr. Cottam, Mr. England, Mr. Greener, and others.—A very neat letter balance by Professor Willis attracted notice.—Some specimens of drawing paper made by Mr. Ranson's patent machinery were exhibited, by which drawing paper may be had in unlimited lengths and in any width up to 4 feet, and also of any degree of fineness or quality.—Mr. Bielefeld's Papier-Mâché ornaments, particularly a Corinthian capital, were objects worthy of notice.—Some specimens of bricks and tiles, made by Bakewell's press, showed the superiority of bricks made by this machine over those of the ordinary kind. Besides what we have already enumerated, there were objects of considerable interest distributed through all the rooms, not forgetting the beautiful models and drawings of works in progress under the directions of Mr. Walker in all parts of the kingdom.

We can truly say that we never saw a party more satisfied than the one of this evening, with the judicious combination of social and scientific arrangements, and the select, yet abundant materials for intellectual, as well as hospitable entertainment provided by the worthy President.

Among the numerous distinguished individuals present, we recognized Earl de Grey, the President of the Institute of British Architects, Lord Western, Lord Lowther, Lord Blayntyre, Sir Robert Peel, Sir Henry Parnel, Sir John Rennie, Sir Duncan M'Dougal, Sir John Rae Reid, Sir George Murray, Sir John Scott Lillie, Sir W. Pearson, Sir H. Ellis, Sir W. Burnett, Sir W. Riddell, Sir James Duke, Sir Hesketh Fleetwood, Sir John Barrow, Sir David Wilkie, Sir Peter Laurie, Mr. Hodges, M.P., Mr. Handley, M.P., Mr. Baines, M.P., Mr. Pease, M.P., Professor Willis, Mr. Babbage, Major Anderson, Col. Colby, Col. Paisley, Col. Thompson, Dr. Reid. Dr. Field, Dr. Roget, Sergeants Spankie and Adams, Mr. Barry, Mr. Tite, Mr. Hardwicke, Mr. Blore, Mr. Basevi, Mr. Donaldson, Mr. Fowler, Mr. Kendall, Mr, Stephanoff, Mr. Landseer, Mr. Stone, and a great number of architects, artists, and most of the members of the Institution of Civil Engineers.

NOTES OF THE MONTH.

The Royal Exchange competition has been decided in favour of Mr. Tite, so that we suppose the works will now go on. Mr. Cockerell his competitor is exhibiting a model of his design in the Old Jewry.—Mr. Barry, as if he were not satisfied with providing for the legislature, has now been engaged in making designs for the new Courts of Law, proposed to be erected in the square of Lincoln's Inn Fields, the expenses to be mainly defrayed from the Suitor's Fund. This plan has received the approbation of the lawyers, and will doubtless be carried into effect, giving the architect the opportunity of adding another colossal building to the architectural contributions of the Victoria era.—The area in Trafalgar-square is now a scene of activity, the footpath which connects the Strand with Cockspur-street, has been brought considerably nearer to the Whitehall side, thus adding a large space to the former enclosure, which we trust will be laid out so as to agree in character with the National Gallery, to which it might be made to give a greater appearance of elevation.—A diminished grant has been taken for the buildings of the British Museum, so that they must linger on in the old style.

In addition to the information which we conveyed last month about the Daguerreotype, we may mention that the attempt to produce permanent engravings so as to admit of impressions being taken, has perfectly succeeded.

Among the men of science, whose loss we have sustained may be mentioned Poisson, the eminent French mathematician, and Sir Robert Seppings.—Sir Robert was surveyor to the navy for nearly fifty years, during which time he was the means of introducing many improvements into the navy, worthy of his own invention, as the circular bow and stern, the system of diagonal bracing, of scarfing short pieces, of making frigate timber applicable to line of battle ships, and the use of the iron knees.—Mr. Whitwell, the architect of the unfortunate Brunswick Theatre, also died recently, but as we hope to attain some particulars respecting him, we shall defer any farther notice of his services.—We may mention among the professional losses, and as a very severe one, the unfortunate destruction of a great part of York Minster by fire, arising from carelessness. We feel pretty sure however that this national monument will be restored.

Durability of Iron Boats.—The question of the durability of iron vessels, of their little liability to accident, and of the ease with which damage done to them may be repaired, appears to be very clearly proved from the experience which has already been obtained on these points; and this is no little, for there are boats built by Mr. Laird in both North and South America—in all parts of India and on the Euphrates and the Indus—in Egypt, on the Nile—and in the Mediterranean—on the Vistula, on the Shannon, and on the Thames. One of these boats on the Savannah has been constantly at work for these last six years without any repair; which is a great test, if we consider the frequent constant caulkings required to preserve a timber-built ship. There is also a steam-yacht built of iron, the Glow-worm, the property of Asheton Smith, Esq. This vessel has made the passage from Bristol to Carnarvon, a distance of 210 miles, in 18 hours. In the report to the House of Commons on steam-vessel accidents, we find the following stated of the Garryowen, one of these vessels:—"We went ashore about two cables' length to the eastward of the pier (Kilrush), and struck very heavy for the first hour. The ground under our weather-bilge was rather soft clay, covered with shingle and loose stones, some of them pretty large. Under our inside, or lee-bilge, the ground was very hard, being a footpath at low water. I was greatly afraid she would be very much injured by it in her bottom, but I am happy to say she has not received any injury; in fact, her bottom is as perfect and as good as on the day she left Liverpool—not a single rivet started, nor a rivet-head flown off. If an oak vessel, with the cargo I had on deck, was to go on shore where the Garryowen did, and get such a hammering, they would have a different story to tell. * * Out of 27 vessels that got ashore that night, the Garryowen is the only one that is not damaged more or less." Colonel Chesney, the commander of the Euphrates expedition, writes thus of the iron vessels which were employed on that service:—"It is but right to tell you that the iron vessels constructed by you far exceeded my expectations, as well as those of the naval officers employed in the late expedition, who would one and all bear testimony anywhere to their extraordinary solidity; indeed, it was often repeated by Lieut. Cleveland, and the others, that any wooden vessel must have been destroyed before the service was one-half completed, whereas the Euphrates was as perfect when they laid her up at Bagdad as the first day she was floated.—*Mr. Cruise, United Service Journal for May.*

QUERIES.

A correspondent is desirous of having some comparison between Sneeze Wood, Right Yellow Wood and Els, and those in use with us, such as Fir, Oak, &c. The woods alluded to may be found in 3rd Vol. Royal Engineers, "Bridge across the River Kat." A. P.

STEAM NAVIGATION.

Oscillating Marine Engines.—This description of engine is daily becoming more generally known and adopted; their great advantage is the extreme lightness and the small space they occupy in a vessel; in both these important particulars the saving is nearly one-half. For vessels of limited draft or for shallow water, they must ultimately become in general use. During the last month we attended the trials of two new steam-vessels, fitted with oscillating engines manufactured by Messrs. Penn & Son, of Greenwich, who have devoted to this class of engine considerable attention, and have fitted up no less than 17 pairs of them; they have not been known to fail in a single instance, and are the admiration of all parties who have witnessed their performance, for the beauty of the workmanship, and the accuracy with which they work, particularly those on board the iron steamers plying on the River Thames above bridge. Messrs. Penn have always found this description of engine give a result fully equal to their dimensions, in comparison with others of the ordinary construction. The first vessel whose performance we witnessed last month was the *Courier*, an iron steamer, built by Messrs. Ditchburn & Mare, of Blackwall, intended to run on the Elbe between Hamburgh and Magdeburgh, 158 feet long at the water line, and 20 feet beam; draught of water, with engines, boilers filled with water, and 15 tons of coke, is only 19 inches in midships, and 14 inches at stem and stern. The engines have cylinders 34 inches diameter, with a 3 feet stroke, and make 27 strokes per minute, and are estimated at 32 horses power each. The weight of engines and boilers filled with water is 37 tons 15 cwt. The paddle-wheels are 15 feet diameter, with float-boards 8 feet long and 13¾ inches wide. The second vessel whose performance we witnessed was the *Queen Victoria*, a new timber-built vessel, constructed by Mr. Thompson, of Rotherhithe. She is 90 ft. long, 13 ft. 9 in. beam, and 2 ft. 9 in. draught of water, fitted with a pair of oscillating engines of 15 horses power each; the weight of the engines with boiler filled with water is only 15 tons, being 10 cwt. to the horse power; the total length of engine-room is 19 ft. 6 in. The speed of this vessel is very little inferior to the Gravesend boats, and is by far the fastest of her power ever produced. She ran the mile at Long Reach with the tide, in 4 minutes and 50 seconds, and against the tide in 6 minutes 36 seconds, giving an average speed of 10¾ miles per hour. This boat is intended to run between Hungerford and Woolwich.

Race between the "Ruby" Gravesend steamer (oak built), and the "Orwell" and "Sons of the Thames" iron steamers.

SIR—As there has been of late much attention drawn to the subject of iron steam vessels, which are announced as possessing great advantage over those of wood, and as I have perceived various notices of the progress of different vessels of this class in your Journal, I shall feel obliged by your giving insertion to the following account of a run which took place on Saturday, May 2nd, between the Ruby, and two of the crack iron steamers.

I should premise that the Ruby has now commenced running for the fourth season, and that no vessel has yet been found that can compete with her. She is timber-built of English oak plank, upon the improved diagonal plan adopted by the Diamond and Woolwich Companies—a plan I have no hesitation in saying is stronger, more durable, and superior to that of any combination of iron whatever. She has never been caulked since the day she was launched, nor a farthing laid out in repairs, and her lines are as true as when they were first laid down on the shipwright's floor.

As the Ruby has been lying by some time to refit for the season, the owners of the two iron boats alluded to, took the opportunity of announcing their respective craft as the fastest vessels in the kingdom, but the Ruby has again taken her place as number one, and like a giant refreshed with sleep, goes better and faster than ever, and the victory she has achieved over the Orwell and Sons of the Thames will no doubt cause their respective partisans to alter their tone for the future.

Your's, &c. A. BILLINGS,
Manager of the Diamond Steam-boat Company.

Race between the "Ruby" and the "Orwell."—1st Trial. On Saturday, at 8 p.m., the Ruby got under weigh from Blackwall, and proceeded slowly down the river, to enable the Orwell to come up, as she was to start from London at eight o'clock. The Ruby went half speed down to Long Reach, no "Orwell" in sight, then tried the mile one hour after flood, spring tide, came back as far as the Halfway House, and discovered the Orwell coming down with plenty of smoke and steam; turned round the Ruby, and went on quarter speed till the Orwell was just four boats astern at Erith, off Cold Harbour Point. Set off full speed, with strong flood tide, two hours flood, (the reasen of placing the Ruby ahead was the fear of hugging, as both were near the shore). The Ruby's engines went off in fine style,—31 strokes, and she soon began to draw away perceptibly from the Orwell, (the Orwell's people at this time hoisted the jack at the main;) however, when off Purfleet the Ruby had gained a quarter of a mile upon the latter vessel, the jack was hauled down, and the Ruby, as the conqueror, hoisted hers, the Ruby gradually gained upon her antagonist, till she stopped at Gravesend Town Pier, when, by observations made, the Orwell was 1½ miles astern, and by time 8 minutes as she passed the Town Pier, thus beating the Orwell in a run of 14 miles about 1½ miles, the distance of four boats length to be deducted, which was the distance the Ruby was ahead when the race began. The Ruby ran the whole distance against a strong flood tide and ahead, in one hour and ten minutes, being seven minutes less time than the Orwell.

Second trial from Gravesend.—The Ruby having stopped ten minutes at Gravesend Town Pier, allowed the Orwell time to come up on the opposite shore and pass Tilbury Fort, when she again started for the chace, and by the time the Ruby had crossed the river against the strong flood in the stream, the Orwell was one mile ahead. The Ruby then ran on for forty-five minutes, in which time she caught the Orwell, and went right by her neck and neck, (you might have tossed a biscuit from one vessel to the other,) headed her by a quarter of a mile, turned round and was back to Gravesend in seventy minutes. In this second race she beat the Orwell one mile in 45 minutes; from the above it will appear that the Ruby, against tide, is full 1½ miles per hour faster than her antagonist.

Race with the "Sons of the Thames."—The Ruby waited at Gravesend till 4 o'clock, and then started up the river to meet the Sons of the Thames. The latter vessel and the Mercury left London at 5 p.m., and at 40 minutes past five they were both discerned at the bottom of Woolwich Reach, the Sons of the Thames full a quarter of a mile ahead of the Mercury. Some colliers being in the stream prevented the Ruby being turned round so soon as she ought to have been, so that when the vessel was got round with her head down, the Sons of the Thames was a quarter of a mile ahead, and the Mercury was just alongside, all three going full speed, and the tide running down strong. It was now evident by the Ruby drawing away from the Mercury, that she was gaining fast upon the Sons of the Thames, which vessel the Ruby came up to in 15 minutes, when the Sons of the Thames had a half minute stop, and the Ruby shot by her, and continued to gain upon her till the arrival at Gravesend Town Pier, when the Ruby was one mile ahead. It should be observed that at Greenhithe, the Sons of the Thames had another short stop, but as she was going all the time with the tide, both these stoppages could not have made more than one minute's difference. The whole distance was done by the Ruby, from the bottom of Woolwich Reach in 55 minutes.

General Remarks.—It is right to observe, that during the above races, the Orwell apparently had 100 persons on board, and the Sons of the Thames about 50, whilst the Ruby had none but her crew. To some this may appear an advantage for the Ruby, but the advantage would have been more in favour of the Ruby if she had had 200 persons on board, as her paddles would then have had more hold of the water, and the vessel would have consequently gone faster; as during the race the Ruby's engines were overrunning their speed for want of proper resistance to the wheels. The Ruby's best speed is when she has 300 persons on board; in proof of which, the Ruby started from Gravesend on Sunday night last, with 300 passengers on board, half an hour after the Sons of the Thames had left, and arrived at London Bridge within three minutes of the time that the latter reached there, the Ruby thus beating the Sons of the Thames 27 minutes in the whole distance, which was entirely against a strong ebb tide. A. B.

The "Elbe" Steamer.—The "Elbe" steamer, which arrived lately from Dunkirk, for the purpose of getting her machinery put on board by Mr. Borrie, of the Tay Foundry, made a trial trip, on Saturday 2nd ult., to prove the efficiency of her engines. She left the West Protection Wall at one o'clock p.m., with about sixty-five of Mr. Borrie's friends on board, for whom he had prepared ample cheer. She proceeded down the river,—rounded the Bell Rock,—run to the Buoy of Tay in fifty-five minutes, being a distance of 12 miles; and from the Bell Rock to the Harbour in two hours and a quarter—a distance of 24 miles—having the ebb tide against her in coming up the river. The vessel was built by Mr. Malo, of Dunkirk, and it was the general impression on board that both the builder and engineer had performed their parts well, and had, between them, furnished a very superior steamer—a fact of which, indeed, they were then witnessing the proofs. The engines (of 160 horse power) were much admired by several professional gentlemen on board for smoothness of action, their elegant and substantial construction, and high finish. The "Elbe" is about 500 tons burden, and belongs to the Dunkirk and Hamburgh Steam Navigation Company. She will shortly join "The Nord"—(fitted out in the early part of last season by Mr. Borrie)—on the Dunkirk and Hamburgh station.—The great increase in the trade of building and fitting up steam ships at Dundee, has rendered the starting of marine engines, at one time a rare, now a very common occurrence amongst us; and—not unmindful of the merits of Mr. Borrie's brother engineers in this place—we have much pleasure in stating that both they and he, from their profound knowledge, great experience, and integrity in fulfilling their engagements in the best and most satisfactory manner, do honour to their profession and to Dundee. On the present occasion, we are specially glad to bear testimony to the steady advancement of Mr. Borrie's well-earned reputation in every department of engineering; and to notice the gratifying fact, that his eminence as a marine engineer has now attracted the attention of Government. The great crane, erected by Mr. Borrie last season, according to the designs of James Leslie, Esq., engineer of the harbour, affords, in connection with our spacious docks, facilities equal, if not superior, to any in Great Britain, for the fitting up of the largest class steamers; and we are happy to learn that Mr. Borrie will, in all probability, be the first to profit by his own labours and enterprise at the port of Dundee.—*Dundee Chronicle.*

TRANSATLANTIC STEAMERS.

Comparison of the passages of the four lines of Sailing Packet Ships between Liverpool and New York, with those of the Transatlantic Steam Ships, during the year 1839.

Sailing Ships.	Longest Outward.	Shortest Outward.	Average Outward.	Longest Homeward.	Shortest Homeward.	Average Homeward.
	Days.	Days.	Days.	Days.	Days.	Days.
Old or Black Ball Line ..	48 0	22 0	33 17	36 0	18 0	22 12
Dramatic Line	38 0	23 0	30 12	25 0	17 0	20 12
Star Line	45 0	27 0	36 0	28 0	21 0	24 0
Swallow-tail Line	45 0	28 0	35 0	31 0	17 0	22 12
Steam Ships.						
Great Western	21 12	13 0	16 12	15 0	12 6	13 9
British Queen	20 9	14 21	17 8	21 12	13 12	16 12
Liverpool	18 12	16 0	17 4	27 0	13 18	15 16
Average of all the Sailing Ships	44 0	25 0	34 1¼	30 0	18 6	22 1
Average of all the Steam Ships	20 3	14 15	17 0	21 4	13 4	15 4¼
Difference in favour of the Steam Ships	23 21	10 9	17 1¼	8 20	5 2	7 13¼

The immense superiority, in point of speed, of the Steam Ships, will be fully evident on inspection of the above table; where the difference in the first instance is more than half; in the second almost three-fifths; in the third more than half; in the fourth more than a quarter; in the fifth near a third; and in the sixth more than a third.

It must, however, be borne in mind that the Transatlantic Steam Ships are yet in their infancy, whilst the sailing ships are perfection; there being no faster ships on the face of the globe than the New York and Liverpool Liners.

Steam Navigation in Germany.—Besides the generally good roads, steam-boats and railway lines are, of late, facilitating interior communication in most parts of Germany. Everybody in England knows the steam-boat communications on the Rhine, which for several years past have poured out a mighty stream of English travellers along the western parts of Germany and Switzerland. In the course of this summer, (1840,) the banks of the Elbe, Saxony, Bohemia, and the whole central part of Germany, will be as easily admissible to the tourist, as the banks of the Rhine have hitherto been. Perhaps a few words on this subject may prove acceptable to persons intending to take a trip or a journey to countries comparatively not so generally known. From London or Hull to Hamburgh steam-boats are regularly running several times every week. Hamburgh is situated about eighty miles inland, on the navigable Elbe. From Hamburgh to Magdeburgh, the journey is performed on board steam-boats, offering the best accommodations. The distance, by the river, is about 250 English miles. From Magdeburgh to Leipsic a railway is constructing; it will be opened in its whole length, in the early part of this summer: the journey—about seventy-four miles—will then be performed in three or four hours. From Leipsic to Dresden a railway has been in operation for more than a year: the distance—seventy-one miles and a quarter—is performed in about 3½ hours. From Dresden another line of steam-boats run, about fifty miles, as far as Tetschen, in Bohemia, where you find yourself at a few hours' journey from Prague and Tœplitz, as well as in the vicinity of Carlsbad, Frezonsbad, and the other celebrated and fashionable Bohemian watering places, which may all all now be reached without any fatigue, or any great expense, five days after embarking from England. From Prague to Brün the distance is about sixty miles, where the traveller will find excellent public coaches, or can take for private use, at any time and at moderate prices, stage-coaches, kept always in readiness by all the post-administrations throughout the Austrian Empire, for the accommodation of families travelling without their own carriages. From Brün to Vienna, the journey—about eighty-five miles—is performed in four or five hours, by a railway which has been in operation for upwards of a year. From Vienna the steam-boats on the Danube run through Hungary to the Turkish frontiers, and the Black Sea, in communication with those plying to Constantinople, Odessa, Trebizonde, &c. In two months, when the whole Magdeburgh-Leipsic Railway is opened, a person may travel from England to Vienna, or to Constantinople by steam, with the exception of a distance of about eighty miles, comprising the two sections of road from Tetschen to Prague, and from Prague to Brün, where neither railway nor steam-boat conveyance is as yet established.—*Athenæum.*

PROGRESS OF RAILWAYS.

Bristol and Exeter Railway.—It is expected that a portion of the Bristol and Exeter Railway, as far as Bridgewater, will be opened in the course of the present year. We understand that the works are proceeding with great activity.—*Railway Times.*

BLACKWALL RAILWAY.

Considerable exertions are being made to open that part of the railway from the Minories to Blackwall on the 18th inst., the anniversary of the battle of Waterloo, when it is expected that his Grace the Duke of Wellington will be present; one line of railway is nearly completed from end to end, *the railway* is carried on a viaduct from the Minories to the West India Docks, thence it is continued on an embankment, until it immerges into a shallow cutting near the terminus at Brunswick Wharf, and terminates under a shed covered with an iron roof, similar to that of the terminus of the London and Birmingham Railway at Euston-square; adjoining the shed is a spacious building for the offices, of the Italian style of architecture, and forms a prominent feature from the river, it is erected from the designs of Mr. Tite the architect, President of the Architectural Society; the Blackwall terminus is most conveniently adapted for steam-boats, being situated on Brunswick Wharf, alongside which the largest class steamers can embark and disembark passengers at all times of the tide, and there are already 2 Gravesend steamers announced for starting from this spot as soon as the railway is opened, and no doubt many others will follow; it is more than probable, before another year passes over, all the steamers which now start from below bridge will make the Blackwall terminus the starting place, thereby avoiding the most dangerous part of the voyage through the Pool, and save in time about three quarters of an hour; by this means the Gravesend boats will be able to make two trips each way every day, and we have no doubt it will also be found the most advantageous route to Woolwich, which can be done by railway, and steamers across the river within three quarters of an hour from the Minories to Woolwich.

To afford every facility for the conveyance of passengers, two classes of carriages have been provided, part of which are already delivered; the first class are enclosed, painted blue, finished very tastefully, and emblazoned with the Arms of the City, and the East and West India Dock Companies, at the same time there is no superfluous ornament or extravagance about them—the second class carriages are open at the sides, and are not provided with seats; the passengers will be obliged to stand during the short time that they are being conveyed, which it is expected will be in about nine or ten minutes; it is stated that the fares will be very trifling, for the first class carriages 6*d*., and the second class 4*d*.

The breadth of the viaduct on the top is 24 feet in clear of the coping stone or cornice, and 28 feet out and out. The arches on the top are covered with asphalte to prevent the percolation of wet through the brickwork. The rails are light in consequence of being relieved of the heavy locomotive, the form is T shaped, and 5 inches deep, they are laid to a 5 feet 1 inch gauge, on transverse sleepers of English fir, 3 feet apart, upon which the chairs are spiked—the rail is secured to the chair in rather a novel manner, a hole is pierced through one of the arms of the chair at right angles to the rail, in which an iron ball about the size of a bullet is dropped and rests against the rail, an iron key or wedge is then driven through an aperture in the same arm of the chair parallel to the rail, which fixes and presses the ball firmly against the latter, this method of fixing prevents any lateral vibration of the rail, and at the same time it allows the free expansion and contraction of the metal. Down the centre of each railway are fixed the pulleys upon which the tail ropes will traverse, placed 30 feet apart; they are 30 inches diameter, and 8 inches wide across the sheave, the rim is lined with rope matting to prevent any noise from the rapid motion of the rope passing over them; the axles turn upon plummer blocks fixed on an iron curb, and over each bearing is a small box for grease to lubricate the axles; the pulleys are fixed vertically throughout the line, both in the straight part and the curves, for the latter they are of a different shape to the others, being 30 inches diameter on one side, and 36 inches on the other; the rim is formed like the outside of the mouth of a large bell.—In the last month's *Journal*, p. 178, is described how the railway is to be worked, by what is technically termed tail ropes, that is, a rope at each terminus is attached to the carriages, and as the rope is coiled up at one end of the railway by the aid of steam-engines, it draws the carriages, and at the same time the rope at the other end is being unwound, thus by the time the forward rope, with the carriage, is wound up at the station at Blackwall, the rope of the station at the Minories is unwound, it is then ready to draw the carriages from the Blackwall terminus back to the Minories. For this purpose there are four of these ropes, two to each line—they are each 3½ miles long, and 5¾ inches diameter, and are worked by two pairs of marine engines at each end of the line, those at the Blackwall terminus are 70 horses power each engine, manufactured by Mr. Barnes, and at the Minories station each engine is 112 horses power, manufactured by Messrs. Maudslays and Field, the latter are of greater power than the former, in consequence of the railway being principally upon the ascent from Blackwall to the Minories; each rope is worked by one pair of engines, the power is tranferred from the engines by means of spur wheels which turn an immense wheel or iron pulley 14 feet diameter in the clear, and 22 feet out and out, and 3 ft. 6 in. wide on the outer circumference, and about 21 inches at the inner circumference,—round this wheel is coiled the rope just described. The engines at the Minories station have each a marine boiler of large dimensions; and those of Blackwall, one pair have three Cornish oval boilers, and the other pair two marine boilers. The engine house at Blackwall is on a level with the railway, and at the Minories it is below the railway, under the arches. The whole of the works do considerable credit to the respective contractors, and to the indefatigable zeal of the engineers, Mr. George Stephenson and Mr. Bidder.

The North Midland Railway.

The North Midland Railway, which forms a communication between Leeds and Derby, was partially opened for traffic on Monday, 11th ult. On Saturday morning, preparatory to that opening, the Directors took a trip along the line, starting from Derby, and traversing to about within eleven miles from the terminus at Leeds. But, although the line is in a condition to be traversed from Derby to the immediate neighbourhood of Wakefield, the portion open to the public extends only from Derby to Rotherham, a distance of about 40 miles, giving, by means of the Sheffield and Rotherham Railway, an uninterrupted railway communication from Sheffield to Derby; from thence by the Midland Counties Railway to Nottingham and Leicester; and by the Birmingham and Derby Railway, to Birmingham and London.

The railway station at Derby is a wonderfully extensive place, which astonishes every person on arriving there for the first time. The length of buildings and covered way now erecting extend, we believe, 1050 feet. So stupendous and magnificent does every thing appear, that imagination almost leads passengers to suppose they are arrived at a market-place for steam engines. The buildings comprise a handsome hall, offices, refreshment and waiting rooms, with requisite conveniences, 230 feet long, 3 stories high, with a façade wall extending each way 410 feet, with openings for the departure of passengers on their arrival. The platform the whole length is formed by large Yorkshire stone landings of a superior quality. The passengers' shed extends the whole length of the walls and buildings, which is covered by a light iron roof of 42 feet span. The centre part of the passengers' shed is 56 feet span, and one bay 42 feet, are also covered, in the whole about 450 feet in length, and supported by handsome iron columns, 22 feet high from the top of the rails.

The arrangements for the lines of rails with the requisite number of turntables are on an extensive scale, and appear to be well adapted for the traffic and depôt for the Company's carriages.

In addition to these buildings there is an engine-house with 16 sides, 134 feet across, with a conical roof and lanthern rising to 54 feet above the floor from the top of the columns, which are 18 feet high; this building is approached by two wings 48 feet long, over which will be a reservoir of water for the supply of the engines, &c.

The preparations for the repairs of the Company's engines and carriages bear the same proportion, the shops averaging 160 feet long each, by 70 feet wide, three stories high, and smith's furnaces to each in connexion with other buildings.

When the extensive nature of these works is considered, and that they have only been 9 months in hand the greatest praise is due to Mr. Jackson, the contractor, for the despatch employed, and the stability and beauty of these structures, which, in connexion with the other stations on the line, reflect the greatest credit on the taste and skill of Mr. Thompson, the Company's architect.—*Abridged from the Derby Reporter.*

Cheltenham and Great Western Union Railway. Engineer's Report, read at the last Half-Yearly Meeting on the 30th April.

Gentlemen—Notwithstanding the many causes of delay which have arisen, all the principal works between the Lansdowne Bridge, at Cheltenham, and the proposed station at Gloucester, have been completed. Two bridges, which are three-quarters finished, and about 20,000 yards of earthwork for the approaches to one of these, namely, the Badgeworth Road Bridge, together with the trimming and soiling of slopes at several places, are all that now remains to be done to complete the whole of this portion of the line, preparatory to the laying the ballast and the permanent way.

The excavation for the junction between the Birmingham and Gloucester Company's station at Cheltenham and the main line at Lansdowne Bridge, has been commenced, and upwards of 40,000 yards of ballast are prepared and set aside.

The cuttings and embankments upon this district, although consisting principally of clay, have not suffered much during the late wet season, and there is now every appearance of the works standing well.

The five permanent shafts of the Saperton Tunnel, referred to in the last Report, have been completed; the sixth, which will be the least in depth, and in other respects the easiest in construction, has not been commenced, in consequence of the taking possession of any land, at that part, involving, by the arrangements with the proprietor, the previous purchase of the whole of the land required for the works generally in the same parish, and which expense you deemed it unnecessary at present to incur.

Between Cirencester and the junction with the Great Western Railway at Swindon, the works have, generally speaking, been actively proceeded with during the last half-year.

Of the masonry of bridges and culverts, which is of course principally summer work, upwards of 3000 yards have been executed, and 7,500 remain unfinished, independently of the covered way, which contains about 5,300 yards, and which is just commenced.

Of the 900,000 yards of earthwork, which, as was stated at the last meeting, then remained to be moved, 400,000 have been excavated, and formed into embankment; and there remain, consequently, 500,000 only, to complete the work.

Upon the whole extent of the works in this district, both the cuttings and embankments have stood remarkably well; the few and slight symptoms of slipping, which occurred on one single part only, have been entirely remedied, and the slopes are now in excellent condition.

Although the average performance, however, has thus, upon a total distance of 17 miles, been such as would, calculating at the same rate, and allowing but moderately for the great advantages of the summer season, ensure the completion of the whole during the next five or six months, this average rate has not been equally maintained upon all the contracts.

The works of the Cirencester branch to Kemble are in a forward state, and might easily be finished during the next August; and the contractor for that part of the line extending from the Great Western Railway to the Red Lion at Minety, a distance of upwards of nine miles, would be able to complete the work, including the laying of the permanent way, by the month of September. An embankment of about 160,000 yards, contract, No. 2, is the principal work to be executed on the remainder of the line; and if very great exertions were used, there can be little doubt that the whole might be brought into profitable work with the commencement of the year 1841, or even by the end of the present year; while, in the mean time, the nine miles before referred to, forming part of a continuous line in conjunction with the Great Western Railway, might be brought into operation at a still earlier period.

The prospect of the early opening of the Great Western Railway, up to Swindon, which may be expected during the latter end of the present year, and the great state of forwardness of several miles at that extremity of your line, would render a successful effort highly valuable. These exertions would, of course, necessarily demand a proportionably rapid expenditure of the capital of the Company—an expenditure, however, which would be unquestionably economical in the end. I am, Gentlemen, your's obediently,

I. K. Brunel, Engineer.

Great Western Railway.—The works in the neighbourhood of Bath are proceeding with very great activity. The foundation of the pier in the centre of the Avon, near the Old Bridge, having been properly laid, operations have been commenced on the Widcombe side of the water. In the Ham gardens the erection of the arches on which the Bath depôt will be situated, is being rapidly proceeded with; whilst some steps have been taken towards erecting the viaduct across the Dolemead and Pulteney road. The tunnel at the top of Raby-place is likewise being finished in a very rapid manner. Towards Hampton the works are of a heavy character, and the utmost despatch is, therefore, observable in that quarter. The workmen have made great progress in the necessary excavations for turning the course of the canal immediately opposite the Cleveland Baths. The embankments for the permanent way are here in a forward state; while, near Hampton church, and in the meadows beyond, the contractors have been very active, and operations have been commenced throughout the extent of the line to Bathford. Altogether, there seems no reason why the line between Bath and Bristol should not be opened towards the close of this summer; and we hear that the Bristol directors have been taking measures which, it is hoped, will secure the opening of their division, and consequently of the entire line, in the middle of next year.—*Wilts Independent.* The opening of the extended line to Steventon, a distance of 52 miles from London, is announced to take place on the 1st of next month. We are happy to find that there is every probability of this grand undertaking being opened between Bristol and Bath early in September. The permanent way has been laid down in the neighbourhood of Keynsham to a considerable extent, and the locomotive engine is at work. Between Keynsham and Bristol the road is all formed, and except finishing off the head of No. 3 tunnel, is in a perfect state. The beautiful elliptic Gothic-arched bridge across the Avon, near the station, is completed, and presents a most splendid appearance. The work does infinite credit to the contractors, Messrs. Wilcox and Son.—*Bristol Mirror.*

Preston and Wyre Railway.—This line of railway, it is expected, will be opened to the public on the 1st or 2nd of July next—the North Union Company finding locomotive power and carriages. Above 1,000 men are engaged in the various works in progress at Fleetwood, among which may be mentioned an hotel, intended to be one of the finest buildings of the kind in the kingdom. A quay of considerable length, the foundation of which rests on iron piles, is also in progress. A light-house, on Mitchell's patent screw principle, has been erected on the end of a sand bank, about two miles out to sea, and will be lighted in the course of next month. The house and lantern stand from 60 to 70 feet high. Captain Denham, R.N., has been for some time busily engaged taking bearings for two other light-houses, which are intended shortly to be commenced. It is intended so to lower the bar, by dredging, that there shall never be less than 12 feet water at low water high spring tides, from the sea direct into the harbour, which can readily be effected. The town of Fleetwood has been tastefully laid out by Decimus Burton, Esq., of London, and a considerable number of houses are in progress.—*Lancaster Guardian.*

Birmingham and Gloucester Railway.—We can now confidently state that the Birmingham and Gloucester Railway will be opened on or before the 1st of July next, from Barnt Green, eleven miles from this town, to Cheltenham. Conveyances will be furnished by the company to perform the intermediate distance, and by the end of the year it is fully calculated that the whole line will be completed, and opened to the public from Birmingham to Cheltenham. —*Midland Counties Herald.*

Northern and Eastern Railway.—A correspondent informs us that the opening of the first portion of the Northern and Eastern Railway will take place at least two months sooner than was anticipated—namely, in August next. We learn from other quarters, that the greatest energy is displayed in the prosecution of the works.—*Ibid.*

Manchester and Birmingham Railway.—The exertions of the various contractors, on this line of railway, at the temporary Manchester terminus, in Travis-street, London-road, have, for the last four or five weeks, been quite astonishing. Since the 1st of April, no fewer than six more arches, of thirty-three feet span, have been completed, besides another skew bridge. The magnitude, or rather the extent of the work, may in some measure be estimated, when it is stated that the arches and bridge have consumed nearly seven millions of bricks. The immense scaffolding or centering, rendered necessary for the erection of the iron skew bridge, which has so justly attracted public notice, has this week been removed, and this noble mechanical structure, which has certainly not its equal in the kingdom—perhaps not in the world, may now be seen to the best possible advantage. Mr. Buck, the company's engineer, has, it is said, the rare merit of designing this extraordinary work of art. The permanent rails are now in the course of being laid; the mode of doing which presents to the eye of the scientific man a degree of firmness and probable durability not perhaps equalled, or even nearly approached, by any other railway line in the kingdom. The rails, remarkably heavy, are fifteen feet in length, and laid on longitudinal pieces of Kyanised timber, the scantling of which is twelve inches by six inches. There are besides transverse pieces, also Kyanised, ten inches by five inches, and screwed to the longitudinal ones every three feet, so that it may with safety be pronounced impossible that the rails, when once truly and firmly fixed in their chairs, can ever afterwards be other than completely parallel to each other; a circumstance that cannot fail to give a motion to the carriages so thoroughly easy and agreeable, as to bid defiance to all attempts at improvements on the plan. When the arches, now 110 in number, are extended to the intended permanent station, Piccadilly, near the Infirmary, the entire length of the viaduct on brick arches will exceed two miles; and the quantity of timber that will be consumed in laying the rails for this length only, will exceed 20,000 cubic feet. It is intended to open the railway, as far as Stockport, on the 29th May.—*Manchester Chronicle.*

Lancaster and Preston Junction Railway.—This railway will be opened for the conveyance of passengers, and of traffic, on Whit-Monday. The works proceed at the Lancaster terminus with considerable activity. A single line of rails has been laid down as far as Galgate, and during the past week a number of men have been despatched to the contract of Messrs. M'Mahon, which, it is rumoured, the Directors intend to take into their own hands, in order to ensure the completion by the 6th of next month, which otherwise is more than problematical.—*Railway Times.*

Paris and Rouen Railway.—The contract entered into between the Southampton Railroad Company and that between Paris and Rouen has been signed, and the works will be commenced immediately. The present railroad from St. Germain will form the nucleus, and from the same point it is imagined the railroad to Belgium might be commenced, and hence that goods could be forwarded directly from Rouen to Brussels, without having to pass through the French capital.—*Globe.*

Glasgow and Ayr Railway.—The most active exertions are making along the line in order to effect the completion of the whole line by the end of July. Betwixt Kilwinning and Dalry the cutting and embanking is carried on during the night as well as the day; and the contractor of this lot, hitherto in the most backward state, is proceeding with the greatest vigour and success. Considerable progress has been made in overcoming the difficulties of the so called bottomless meadow, which has required so much deposit in the embanking. The most formidable part of it yet remaining extends to about three hundred yards; and it is singular to observe that as the earth is poured on the embankment, the surface on both sides is heaved up to a considerable extent. As the workmen proceed, they find each new piece of embankment to sink during the night, which depression they have to restore by fresh portions of surface material. Having once surmounted this obstacle, their task will be comparatively easy, as the embankment at this part of the line is only three feet. The meadow which lies betwixt Kilbirnie and Lochwinnoch Lochs, is supposed to have been at one time also covered with water, but it was not considered to have retained so much moisture as to cause such extra labour to make it properly *terra firma*, otherwise some change would have been made on the line, by which it might have been avoided. The lodging-houses in Kilwinning, Dalry, and Beith, are crowded with labourers employed on the railway, whose expenditure must be felt in a considerable degree by those villages. The iron-works at Dalry are in the progress of building, and appear to be on a very extensive scale.—*Glasgow Courier.*

ENGINEERING WORKS.

The Royal George.—Col. Pasley began his proceedings for the removal of the wreck of the Royal George on the 1st of last month, but up to the 12th nothing very remarkable was effected. Two guns, the rudder, and a considerable quantity of timber, were recovered: but as these were merely the fragments of last year's work which the inclemency of the season prevented the engineers from picking up, no serious measures were deemed necessary till Tuesday, 12 ultimo. At eight o'clock in the morning, the red flags at Spithead announced that a great explosion was to be attempted; and at eleven one of those huge cylinders which have formerly been described, filled with 2116 lb. of gunpowder, was lowered to the bottom. One of Col. Pasley's divers (George Hall) who has acquired great expertness in these operations, descended his rope-ladder a little in advance of the cylinder, and succeeded in fixing it securely to one of the lower gudgeons or braces on the rudder-post, within six or eight feet of the keel. The diver having remounted, and the vessels being withdrawn to a safe distance, the enormous charge was ignited by means of the voltaic apparatus. Within less than two seconds after the shock was felt, the sea rose over the spot to the height of about 15 feet, or not quite half so high as it did on occasion of the great explosions last year—a difference ascribable, probably, to the cylinder on the present occasion having been placed under the hull instead of alongside it. The commotion in the water, however, was so great as to cause the lumps and lighters to pitch and roll at a great rate. The whole surface of the sea for several hundred yards round was presently covered with dead fish and small fragments of the cylinder. Amongst these were innumerable tallow candles, and a mass of butter a foot and a half in length, evidently driven up from the purser's store-room. As soon as the vast commotion in the water had subsided, and the boats had returned from the universal scramble for the candles and dead fish, the diver proceeded again to the bottom, and soon reported that the whole stern of the ship had been driven to pieces, and that, so far as he could ascertain, there was now a free and wide channel directly fore and aft the ship, from stem to stern, through which both the flood and ebb tides will rush, and thus the mud with which the hull of the Royal George has been silted for half a century, will be washed out, and the way cleared for Col. Pasley's further operations.

Staffordshire and Worcestershire Canal Company.—This company, having purchased of the Moat Colliery Company the unexpired term of their lease of the river Sowe, up to this town, have this week employed no less than 150 men in improving and making navigable for heavily laden vessels, that part of it between this town and Radford Bridge. The work has been actively proceeded with, the bed of the river being lowered in some parts about two feet, widened or narrowed as required, and thoroughly cleansed. This improvement has been effected with the view of opening a market for Lord Hatherton's and other collieries at Church Bridge, near Cannock, to which place a branch from the canal is in progress, at an estimated expense of £20,000. It is expected that the branch will be completed by the end of the present summer; so that the inhabitants of this town may reasonably expect both a cheaper and better supply of the necessary article of fuel.—*Staffordshire Gazette.*

Portsmouth Dockyard.—A Board of Admiralty, consisting of Earl Minto and Sir W. Parker, lately visited the port. Several material points have called their Lordships' attention to this neighbourhood: in the first place, the floating bridge approaches required their inspection, in which they were assisted by their engineer, Captain Brandreth; and we have no doubt that all matters in dispute will be satisfactorily arranged for the company, and advantageously for the public. We have reason to think that Mr. Lindegren's projecting premises will be purchased and thrown open, by which means upwards of 60 feet of high water beach will be available to the watermen; care, however, should be taken that the new beach be properly formed, for, as the situation is removed from the operation of the tidal influence on the shingle, nature will provide nothing but mud to land on, unless the engineer shall exercise his art and procure a more hardened substance.

NEW CHURCHES, &c

Dorsetshire.—The foundation stone of the new church at Ash was laid on Wednesday, 13th ult., by the Rev. R. Oakman, the vicar, in the presence of a very large company, comprising about 2.000 of the nobility, gentry, and yeomanry of the county.—*Dorset County Chronicle.*

Nottingham.—The beautiful church of St. Mary, which has justly excited so much admiration from antiquaries, has been completely restored, at an expense of 3,000*l.*, which sum was raised by subscription; and Mr T. Wright, of Upton-hall, has purchased and presented to the church a beautiful Crucifixion, by Fra Bartolomeo, and one of his finest works, as an altar-piece.—*Nottingham Herald.*

Essex.—North and south transepts are now in progress at the parish church of Messing, near Colchester, under the direction of John Burges Watson, Esq., of 39, Manchester-street, London. The style is early English; there is a beautiful eastern window in stained glass and of great antiquity, supposed to have been of Dutch origin, and is an object of attraction to visitors; it is also contemplated to have a new tower and spire, for which designs have been furnished.

Sisters of Mercy in Birmingham.—John Hardman, Esq., of Handsworth, has generously allotted to the use of this establishment, a piece of land opposite his own dwelling; and a convent is now in progress, from the designs of A. W. Pugin, Esq., the architect of St. Chad's Church. The conventual buildings will consist of chapel, cloister, community room, refectory, offices, and private chambers, or, as the are technically termed, cells; to which will be added a refectory, school-room, and suitable apartments for about thirty female orphan children. The plan of the building is based chiefly upon that of "Brown's Hospital" in Stamford; and, as Mr. Pugin studies propriety of destination in all his edifices, we have reason to know that the one in question will not only be ornamental and picturesque, but in every respect *conventual*—in fact, the only entire building, with purely conventual features, in the country.—*Midland Counties Herald.*

Staffordshire.—The new church of St. James', at Handsworth, was consecrated on the 22nd April last. It is built in the early Gothic style, with a tower of three stories at the west end, it contains 926 sittings, of which 518 are free. Mr. Richard Robinson of Wolverhampton, was the contractor, for the sum of £2,500,—and Robert Ebbels, Esq., the architect.

MISCELLANEA.

Artificial Asphalte.—The substitution of boiling coal tar instead of water, with crushed caustic lime and screened gravel or sharp sand, in the usual proportions for making concrete, forms an admirable asphalte, perhaps equal to the foreign asphalte. C. F. P.

Wood Pavement.—A considerable length of the Strand is now being paved with wood; the blocks are hexagonal, 9 inches deep, and 9 inches across at right angles to the sides; the upper edge is chamfered all round, to form a groove to prevent the horses from slipping. The wood is laid on a bed of broken granite, and to us it appears that the work is being done in a very clumsy and unsatisfactory manner.

Asphalte.—This material has been used in lining the reservoirs and tanks of the Southampton Railway, and found to answer very well; it has also been used for covering terraces—in some situations it has not been very successful, but in others it is perfectly water-proof. An additional length of the footway in Whitehall has been laid with this material.

Thames Tunnel.—The Company have obtained another Act of Parliament which empowers them to purchase the property on the Middlesex side of the river necessary for the approaches; the works will now proceed with rapidity. The tunnel is completed to within 50 feet of the wharf at Wapping, and preparations are making to commence immediately the sinking of the shaft on the Middlesex side of the river. The formation of the new shaft, as well as the remaining portion of the tunnel, will be carried on at the same time, and it is expected that in about four months they will be completed. Not less than 150 workmen are at present engaged in finishing the interior of the western arch roadway, preparatory to its being opened, in the first instance, as a thoroughfare for foot passengers.

To consume the smoke from a boiler furnace.—Let the fresh coals be put into the furnace as near to the door as possible, and leave the door open for a space of two or three inches to allow cold air to enter, this will keep down the greater part of the smoke which will be consumed; the same may be applied to marine engines. This method will be found as efficacious as any patent that has yet been taken out. M.

Safety Valve to Steam Boilers.—At a meeting of the Society of Arts, on Wednesday, May 6th, the gold Isis medal was awarded to Mr. Robert M'Ewen, for a mercurial gauge which answers the double purpose of an indicator of steam-pressure and a safety-valve for engine boilers. The novelty of the invention consists in the employment of a mercurial tube as a safe-vent for the steam, these tubes having hitherto been used only as indicators of pressure, and of a length sufficient to allow the steam to acquire a dangerous degree of pressure, without giving any other notice of the fact than what may be observed by the eye. As the action of Mr. M'Ewen's safety-valve depends on a purely *physical* principle, viz., the opposition of the elastic force of steam to the static pressure of mercury without a *mechanical* obstruction of any kind, it affords a free vent for the steam when its pressure exceeds the limit, corresponding to the length to which the tubes are adjusted, according to the strength of the boiler.

India Coal.—Dr. Hutchison, of the Madras artillery, has drawn up a report on the coal-fields recently discovered in the vicinity of Mergui, by which it appears that this coal is easy of access, lying at no great depth beneath the surface, so that shafts may be sunk without difficulty. For its conveyance there seems to be every facility, the river being adjacent, and a land carriage of one mile only being required. It is not stated whether the quality of the coal has been tested by experiment, but we presume it to be the same of which Dr. Heifer spoke so highly in his communications. Steamers will begin to ply between the different ports in the bay of Bengal; and the immediate coal dépôts between the Presidencies and Suez will be more plentifully supplied, and at a cheaper rate. The effect these circumstances will produce on the destinies of India can scarcely be estimated.—*East India Magazine.*

LIST OF NEW PATENTS.

GRANTED IN ENGLAND FROM 28TH APRIL TO 23RD MAY, 1840.

William Crane Wilkins, of Long Acre, Lamp Manufacturer, and Matthew Samuel Kendrick, of the same place, Lamp Maker, for "*certain improvements in lighting and in lamps.*"—Sealed April 28; six months for enrolment.

John Inkson, of Ryder Street, Saint James', Gentleman, for "*improvements in apparatus for consuming gas for the purpose of light.*" Communicated by a foreigner residing abroad.—April 30; six months.

Orlando Jones, of the City Road, Accountant, for "*improvements in treating or operating on farinaceous matter to obtain starch and other products, and in manufacturing starch.*"—April 30; six months.

William Pierce, of James Place, Hoxton, Ironmonger, for "*improvements in the construction of locks and keys.*"—May 2; six months.

Arthur Wall, of Bermondsey, Surgeon, for "*a new composition for the prevention of corrosion in metals, and for other purposes.*"—May 2; six months.

Thomas Gadd Matthews, of Bristol, Merchant, and Robert Leonard, of the same place, Merchant, for "*certain improvements in machinery or apparatus for sawing, rasping, or dividing dye, woods, or tanners' bark.*"—May 5; six months.

William Newton, of Chancery Lane, Patent Agent, for "*an improved apparatus and process for producing sculptured forms, figures, or devices in marble, and other hard substances.*" Communicated by a foreigner residing abroad.—May 5; six months.

George Mackay, of Mark Lane, Ship Broker, for "*certain improvements in rotatory engines.*" Communicated by a foreigner residing abroad.—May 5; six months.

William Beetson, of Brick Lane, Old Street, Brass Founder, for "*improvements in stuffing-boxes applicable to water-closets, pumps, and cocks.*"—May 5; six months.

Frank Hills, of Deptford, Kent, Manufacturing Chemist, for "*certain improvements in the construction of steam-boilers and engines, and of locomotive carriages.*"—May 5; six months.

Bernard Aube, of Coleman Street Buildings, Gentleman, for "*improvements in the preparation of wool for the manufacturer of woollen and other stuffs.*"—May 7; six months.

Thomas Walker, of Galashiels, in the county of Selkirk, Mechanic, for "*improvements in apparatus applicable to feeding machinery employed in carding, scribbling, or teazing fibrous materials.*"—May 7; six months.

Henry Holland, of Darwin Street, Birmingham, Umbrella Furniture Maker, for "*improvements in the manufacture of umbrellas and parasols.*"—May 7; six months.

Henry Montague Grover, of Boveney, Buckinghamshire, Clerk, for "*an improved method of retarding and stopping railway trains.*"—May 7; six months.

Miles Berry, of Chancery Lane, Patent Agent, for "*certain improvements in treating, refining, and purifying oils.*" Communicated by a foreigner residing abroad.—May 9; six months.

Auguste Moinan, of Philpot Terrace, Edgware Road, Clock Maker, for "*certain improvements in the construction of time-keepers.*"—May 9; six months.

Rice Harris, of Birmingham, Gentleman, for "*certain improvements in cylinders, plates, and blocks, used in printing and embossing.*"—May 12; six months.

George John Newberry, of Cripplegate Buildings, Manufacturer, for "*certain improvements in rendering silk, cotton, woollen, linen, and other fabrics, waterproof.*"—May 12; six months.

Henry Dircks, of Liverpool, Engineer, for "*certain improvements in the construction of locomotive steam-engines, and in wheels to be used on rail and other ways, parts of which improvements are applicable to steam-engines generally.*"—May 12; six months.

John Davidson, of Leith Walk, Edinburgh, for "*an improvement in the method of preserving salt.*"—May 12; six months.

Peter Bradshaw, of Dean, near Rimbolton, Bedford, Gentleman, for "*improvements in dibbling corn and seed.*"—May 12; six months.

James Walton, of Sowerby Bridge, Halifax, Cloth Dresser, for "*improvements in the manufacture of beds, mattresses, pillows, cushions, pads, and other articles of a similar nature, and in materials for packing.*"—May 12; six months.

Richard Foote, of Faversham, Kent, Watch Maker, for "*improvements in alarums.*"—May 12; six months.

John Joseph Mechi, of Leadenhall Street, Cutler, for "*an improved method of lighting buildings.*"—May 12; two months.

Bryan J'Anson Bromwich, of Clifton-on-Teme, Worcester, Gentleman, for "*improvements in stirrup-irons.*"—May 13; six months.

Henry Ernest, of Gordon Street, Middlesex, Gentleman, for "*certain improvements in the manufacture of machines, usually called beer-engines.*"—May 13; six months.

William Hannis Taylor, of Norfolk Street, Strand, Esquire, for "*certain improvements in the mode of forming or manufacturing staves, shingles, and laths, and the machinery used for that purpose.*"—May 20; six months.

William Bush, of Camberwell, Merchant, for "*improvements in fire-arms and in cartridges.*" Communicated by a foreigner residing abroad.—May 20; six months.

James Buchanan, of Glasgow, Merchant, for "*certain improvements in the machinery applicable to the preparing, twisting, and spinning, and also in the mode of preparing, twisting, and spinning, of hemp, flax, and other fibrous substances, and certain improvements in the mode of applying tar or other preservative to rope and other yarns.*"—May 22; six months.

James Callard Davies, of College Place, Camden Town, Jeweller, for "*an improved clock or time-piece.*"—May 23; six months.

TO CORRESPONDENTS.

If W. B. *will favour us with the particulars of the addition to Thorney Abbey, we will insert them next month.*

S. P.'s *method of constructing a Bridge is impracticable, it is like building castles in the air, his communication will be left at our office.*

We thank Mr. Plank *for his correction, it will be forwarded to the author of the paper.*

Mr. Phillip's *communication is unavoidably postponed, together with some others.*

"Amicus" *is not aware of the difficulties and delays in getting the reports he mentions, we have inserted some in the present Journal.*

"*Report on the plans for preventing accidents on board of steam vessels,*" *we had intended to have given this month, but in consequence of an over pressure of matter, we are compelled to postpone it for the next Journal.*

We are obliged to Capt. P. *for his communication, the extracts from Palladio we have not inserted, as the work is accessible to most architects—his other paper explaining how increased buoyancy might be obtained by filling the sides of vessels with* gas *in reservoirs, we think is impracticable, as the weight of the reservoirs containing the gas and the increased ballast at the bottom of the vessel, will more than counterbalance the buoyancy of the gas.*

The communication from Mr. Nicholson's reply to Mr. Buck, &c., was received too late in the month for the present Journal, we will not fail inserting it next month.

Communications are requested to be addressed to "The Editor of the Civil Engineer and Architect's Journal," *No.* 11, *Parliament Street, Westminster.*

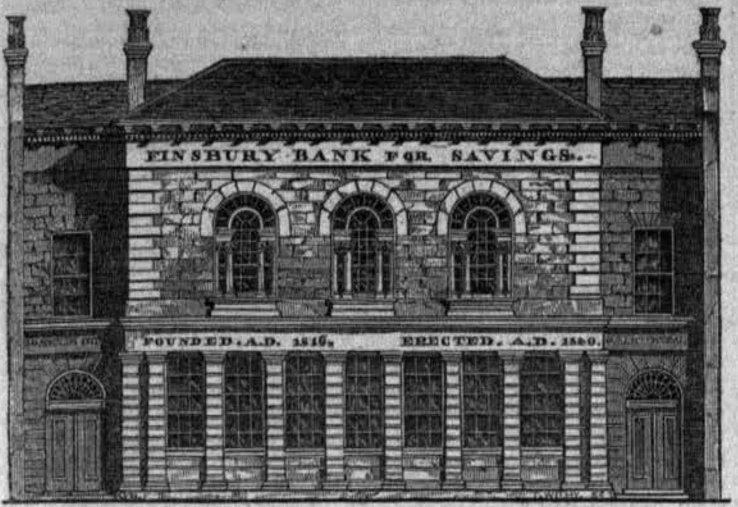
Books for review must be sent early in the month, communications on or before the 20th (if with wood-cuts, earlier), and advertisements on or before the 25th instant.

The First Volume may be had, bound in cloth and lettered in gold, Price 17*s*.

⁂ The Second Volume may also be had, Price 20*s*.

FINSBURY SAVINGS' BANK.

ARCHITECT, ALFRED BARTHOLOMEW.


FINSBURY BANK FOR SAVINGS.
FOUNDED. A.D. 1816.
ERECTED. A.D. 1840.

THE sum allowed for the erection of this building was only £2850, which, taking into consideration its size, is not 50 per cent. upon the ratio of cost of any other of the savings' banks of the metropolis; the consequence is, that it is neither built externally of the materials, nor finished internally in the style, which the architect of it desired: a previous design was prepared by him for a larger and superior building, to be finished externally with Portland stone, internally fitted up in a handsome manner, and with the novelty of an entire fire-proof construction, the particulars of which are to be found in Mr. Bartholomew's "Specifications for Practical Architecture," just published. The absolute tender for the difference between external stucco and Portland stone (the frontage remaining the same), was less than 5 per cent. upon the cost of the original design, and less than 7 per cent. upon the reduced one; and the fire-proof construction added only about 6 per cent. to the cost.

The frontage of the building extends 72 feet, and consists of a range of seven large windows, for the admission of a great body of light to the offices, between ten rusticated pilasters, 13 ft. 6 in. high, which are diminished. They are surmounted by an entablature; above is a range of three Palladian windows (lighting a board-room), flanked by long rustic quoins, and surmounted by a fascia and a bold cornice, from the outer edge of which commences the slope of the roof, which has a sunk or concealed gutter. At the sides of the pilastrade before mentioned, are rusticated wings, containing the entrances, each 6 feet wide, above which the building retires, so as to detach it from the adjoining houses. All the fascias are made very broad, for the purpose of receiving inscriptions to be visible at a considerable distance.

The interior of the building, which is totally destitute of every description of decoration, contains a public office 30 feet long, three private offices, a strong-room, a depositors' waiting-hall 44 feet long, two entrance halls, each 11 feet 8 inches by 20 feet, a board-room 30 feet by 14 feet, two staircases, and besides these thirteen domestic apartments, most of which are concealed from view in order to avoid as much as possible the meanness of many small external windows.

All the proportions of this building have suffered from retrenchment, and it is thus rendered in dimension, having regard to its business, twice as large as any similar establishment.

The external cornices and chimneys are not yet finished.

The sum allowed for this building was so restricted, that the architect chose to be at some part of the expense of the external decorations of it, rather than suffer it to undergo farther mutilation.

ON THE PRESENT STATE OF THE ART OF GLASS PAINTING IN ENGLAND AND FRANCE, AND ON THE NECESSITY FOR EFFORTS IN ITS FAVOUR.

BY GEORGE GODWIN, JUN., F.R.S. & S.A.*

THE extraordinary degree of apathy universally manifested with regard to the well-being and progress of an art, the admirable results of which throughout a period of at least five or six hundred years are scattered over the whole of Europe, is so much to be lamented, and calls so loudly for exertion on the part of those who feel its importance, that I am induced to raise earnestly a feeble voice in its behalf. And I do this without any fear of the imputation of vanity or self-confidence, and with a strong hope that however weak the advocate, some good may be effected by the effort. Many men with earnest wishes and strong inward promptings, avoid speaking out simply through feelings of their own want of importance and dread lest interference on their part may be construed into presumption, or at the best be entirely disregarded. This I am disposed to think is an evil and should be combatted, experience showing that a word uttered in due season, however humble and weak the utterer, may, and often does, have effects which could not possibly have been calculated upon: and further, that an individual, however unimportant who with strong conviction iterates, and reiterates the necessity of a certain step will be sure of finding a response in the public mind, provided his statement be founded in truth, and sooner or later will most probably effect his purpose. This introduction is a little too pompous for the very brief remarks which follow, but nevertheless perhaps, may not be deemed useless or impertinent.

To bring together and relate the circumstances attending the progress of the art of painting, and staining glass from the foundation of Constantinople, where it attained a certain degree of excellence, and whence, there seems reason to believe, it was brought to Rome, and afterwards by our Norman, if not our Saxon, ancestors to England, would be a pleasant task, but as all the facts are well known, the repetition might prove tiresome. In the 14th and 15th centuries the art reached great perfection in England, and ultimately became so popular that stained glass was not merely used for ecclesiastical purposes, but as an essential feature of decoration in domestic architecture. At the Reformation the onward progress of glass painting was checked, and many fine specimens of it were destroyed as evidences and encouragers of superstition. Further ravages were made in the reign of Charles I. and during the continuance of the Commonwealth; indeed it seems surprising, bent as the Puritans were upon its destruction, that so much yet remains,

> "Innumerable of stains and splendid dyes.
> As are the tiger-moths deep damask'd wings,"

to prove its power in exciting holy emotions; "to add new lustre to religious light," and a further charm to the many inherent beauties of those numerous buildings in the pointed style of architecture scattered over England, of which we have just right to be proud.

Dallaway in the first edition of his "Observations on English Architecture,"† gives a valuable list of the various professors of the art of painting on glass, who practised in England from the period of the restoration of the reigning family up to the year 1805, when Francis Egington died,—a man of celebrity in the exercise of the art, who had been established near Birmingham.

A little time previous to this date, Charles Muss came to London to obtain employment as a colourer of prints. He lodged at the house of an individual who painted upon china for Messrs. Mortlock, and was induced by accident, on the death of his landlord, to undertake the completion of some work of this description which had been left unfinished. Succeeding in this he became a china painter, and ultimately a glass painter, and was employed in that capacity for many years by Mr. Collins of the Strand. He afterwards executed a number of works in his own name,—of which one of the finest that I know is a window in the church of St. Mary at Redriff. Muss had a number of pupils, some of whom are now practising: as for example Mr. Nixon and Mr. Hoadley. Backler, who painted the window at St. George's church in the Borough, was another of his scholars, as was also Mr. John Martin—since so deservedly celebrated in another branch of art; a man of whom it may be said, in a parenthesis, our age will boast hereafter.‡ A work in stained glass from his hands is, I believe, to be found at Lord Listowel's, at Kensington. The peculiarity to be observed in paintings of the Muss school, (I think it may also be termed the *defect*,) is the great degree of opacity given to some of the colours; whereas in the best works of the artists of the middle ages all the colours are more or less translucent. Of all Muss's living pupils Mr. Nixon, of the firm of Ward and Nixon, has perhaps most entirely abandoned this peculiarity, and the result apparent in such of the works executed by this firm as I have examined, is of an exceedingly satisfactory nature.

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* The substance of this paper was read at the Royal Institute of British Architects, June 1, 1840.

† London, 1806.

‡ "It is only when we are skeletons that we are boxed and ticketed, and prized and shown."—*W. S. Landor.*

The branch of glass painting now most encouraged appears to me, although of itself charming, a departure from the special character of this art. I allude to the imitation of oil paintings on single plates of glass, or of plates composed of very few large pieces,—such for example as the copy of "Belshazzar's Feast," and others of Martin's wonderful conceptions, which have been so well executed by Messrs. Hoadley and Oldfield.

Dallaway says that Thomas Jervais, who died in 1801, was the first who was distinguished for exquisitely finishing small subjects, since which time this department of the art has been much studied and has been brought to a point of great excellence. In productions of this sort a variety of colours are fused into the same piece of glass, and it becomes almost impossible to obtain with such certainty equal effects of colour, as when each tint is on a separate piece of glass, although this style has undoubtedly its own advantages. In the works of the earlier manner the colours are nearly always on separate pieces, the various morsels being united by leaden or copper bands, and shaded with brown. A hardness of outline resulted, and a great excellence in drawing was not easily attainable, but there is nevertheless about them a character peculiarly their own which should not willingly be lost in decorating ecclesiastical structures of the style of the middle ages. Of course we should not give up the power we possess through our improved mechanical skill, to avoid injurious joinings where this can be done without diminution of excellence in other respects; what I would simply express is, my conviction that to endeavour to make stained glass appear to be anything else than stained glass is not desirable.

An error, as it appears to me, is sometimes committed in placing copies of the later Italian masters in the windows of structures erected in the earlier pointed styles of art. Our improved taste has made us feel that to place an Italian altar-piece in a Gothic church is to violate propriety and destroy harmony. Why should the filling-in of the windows escape the general law that all portions of a building avowedly in imitation of the works of a particular period should be congruous. The windows ought unquestionably to accord with the building itself, both as regards their design and the technical peculiarities which mark the genuine works of the period imitated.

Mr. Willement, whose works are well known to all who have inquired into the subject, is justly celebrated for his imitations of the efforts of the earlier artists in stained glass, and of these no other example need be given than the principal window in St. Dunstan's church, Fleet-street, executed by him a few years since. This window was presented to the parish by the Messrs. Hoare.[*]

In France at this time the art of painting on glass is making satisfactory, although but gradual, advances. During the period of the first revolution the abhorrence of every thing connected with royalty which prevailed, led to the suppression of the government establishment for the manufacture of glass and china at Sêvres, and to the destruction of numerous fine specimens of its skill. While many glass windows were broken and melted down in the vain belief that as gold was employed in the preparation of some of the colours, it could be extracted and made available. Buonaparte sought to re-establish the manufactory on its former footing, but found that, although they possessed all the written details of the processes, France which had produced so many noble works in stained glass, and the most perfect existing history of its progress and manufacture, was unable then to furnish artists capable of regaining for the establishment any of its former reputation. The art however was still exercised, but so little progress was made that prior to the year 1825, the practice of it appears to have been confined to this royal establishment at Sêvres, fame, not profit, being the object aimed at, and even there great success does not seem to have attended their efforts, if we may judge from the following circumstance. A window of painted glass was completed at Sêvres in 1827, for the church of *Notre Dame de Lorette*, and when fixed, which did not occur until some years afterwards, in consequence of the building remaining unfinished, it was declared to be a *chef d'œuvre* of modern art. In less than eighteen months however, as I am informed by a correspondent, the colours had faded so considerably as to render the window a public monument of failure, and permission to take it down was in consequence applied for. The dampness of the building was the cause assigned for the mishap, but insomuch as the carcass had been erected many years, this could not have been very excessive: and whether so or not, this failure could not have occurred had the colours been properly fused into the glass. Want of effect in some of the works executed at Sêvres has been attributed to the employment without modification, of the same mode of operation as is successfully adopted for porcelain. The bases of the colours are the same for one as for the other; but glass, in consequence of its translucent nature, requires that the tints should be much more intense than it is necessary they should be for china, which is opaque.

We have said that, prior to 1825, the art of painting on glass was nearly confined to the establishment at Sêvres. In that year Monsieur le Comte de Chabrol, then Prêfet of the Seine, entered into correspondence with Mr. Jones, a pupil of our countryman, Charles Muss, already mentioned, the result of which was that Mr. Jones went to Paris with the intention of forming a government establishment for painting upon and staining glass, in which pecuniary profit was to be regarded as a main consideration. Immediately on the arrival of Mr. Jones, M. de Chabrol was virulently attacked for affording encouragement to a foreigner "to the injury of native talent," and for four years the question was violently agitated without any result. At the end of that time, fatigued by the continued opposition to which he had been subjected, Mr. Jones abandoned the idea of a government establishment, and devoted his energies to forming and carrying on with success a private undertaking. He proposed to the proprietors of the glass works at Choisy le Roi, two leagues from Paris, to establish a department for staining and painting on glass, in conjunction with the other operations. They assented to his views, affairs were put *en train*, and success has attended the attempt. Nearly all the persons at present employed in it have been educated to it by Mr. Jones, and, in consequence, work well together, a circumstance which, in connexion with the opportunities he possesses for making experiments at small cost, and the comparatively trifling expence of the recipient in France, places stained and painted glass within the means of a much larger class of persons there than it is in England. Green, blue, or red glass, for example, may be bought in Paris for 1½ franc per foot, purple for 2 or 2½ francs, and ruby for 3 francs. Progress in the art of staining glass appears to have been greatly aided by M. Bontems, the director of the works at Choisy, who has devoted much time to the attainment of the ruby coloured glass of which such magnificent specimens are to be found in earlier works. I am informed he has succeeded, after repeated experiments, in obtaining it at a much cheaper rate than formerly by the use of oxide of copper instead of oxide of gold, and without any diminution of excellence. The experience of English glass stainers is opposed to this statement, as all ruby coloured glass prepared here from copper is inferior. I am not able, however, on this point to do more than repeat what I am told. M. Bontems has recently visited the costly establishments of the King of Bavaria at Munich, where, although he found, as he considered it, an inferiority on the whole, he gained much information. The princely magnificence of the King of Bavaria in all matters that relate to art, and the extraordinary results he has produced in his little capital, will serve to throw a halo round his name in the pages of future historians.

The establishment at Choisy possesses an advantage in the friendly co-operation of some artists of talent, not glass painters. In order to render a design effective on glass, such changes and alterations from the original picture are sometimes necessary, as would be entirely objected to by painters nervously careful of their fame, so that it is sometimes difficult to find artists of ability willing to exert their talents for the purposes of glass-painting, as they must be subservient in a certain degree to him who has the execution of the work, and on whom of course depends the effect to be produced. The last works exhibited in Paris by the Choisy establishment were designed by M. Adolphe Fries, a warm friend of the undertaking, and obtained much commendation. It is hardly necessary to say that since the successful issue of the experiment at Choisy le Roi, attempts have been made to form other similar establishments, but, being ill conducted, have, for the most part, failed. Men were even seduced from Choisy by golden promises to aid the undertaking; but the directing mind being absent, found themselves powerless.

The works at Sêvres are chiefly limited to the supply of government wants. The only window lately executed by them which I have seen, is in the cathedral at *Eu*, near Dieppe. This was the gift of the King of the French, who, on more occasions than one, has evinced a strong desire to advance the arts in his kingdom.

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[*] Although this paper does not pretend to give the names of *all* the professors of glass painting practising in England; (unfortunately necessarily few), the writer cannot omit to mention Mr. Millar, who has executed a number of works at Stonyhurst, and Mr. Wilmnshurst whose large production The Field of the Cloth of Gold" was destroyed by fire.

Circumstances are much more favourable in France to the progress of the art of glass painting than they are in England. The material is so much cheaper, and the remuneration expected by artists for their labour is so much less, even after making all allowances for the difference in the value of money in the two countries, that the greatest obstacles in the way of experimental essays amongst us do not exist there.

It is really to be desired that some efforts will shortly be made in England by men in authority, to prevent the decay of an art so beautiful and so valuable as this which we are now considering. Its present languid state is most deplorable to behold, and cannot but terminate fatally unless means be taken to inspirit and invigorate those who are engaged in it. It is not asked that government should form large and expensive establishments for this purpose, as at Munich, such a course is not necessary, perhaps, even, it would be unadvisable; but it does appear exceedingly desirable that they should, by occasional commissions and discriminating assistance, draw public attention to the subject, raise the hopes of its professors, and offer some inducement for increased exertion on their part. In consequence of the improved state of chemical and physical science, we have the means of producing works in painted glass superior to anything that has yet been done, were proper encouragement afforded to develop our resources; unfortunately, a directly contrary opinion prevails, and this fact, therefore, cannot be insisted on too vehemently.*

Concerning the importance of stained glass,

> " glass of thousand colourings,
> Through which the deepened glories once could enter,
> Streaming from off the sun like seraphs' wings."

to increase the solemnity of an ecclesiastical building, and induce holy and religious feelings—apart from its influence as a work of art—none disagree; and yet, in consequence of the niggardly and ill-advised system of church building pursued at this time, few of the new edifices which are rising in all directions—mean, contracted, and poverty-stricken—afford any specimens of it. If government were to set an example by the bestowal of a few windows, there are many individuals and public bodies who might be persuaded to follow it. In early times, when funds were needed for the erection of places of worship, the mendicant monks promised all who would subscribe, that they should be represented in stained glass,—that they should

> " knely before Christ in compas of gold,
> In the wyde windowe westward, wel neigh in the middell."

Notwithstanding it be pandering to the vanity and pride of frail humanity, we would promise this and more than this, to all who were willing to aid in the improvement of our churches, and to forward an art which has such claims upon the moralist and the man of taste; and we would point out that, by assisting to implant a knowledge and a love of art in the minds of their fellow men, they were advancing their welfare, raising them in the scale of beings, and effecting a national good.

Let us hope that better times than the present are in store for the lovers of this particular art—or rather, let us not be contented with simply hoping, but diligently set our own shoulders to the wheel, and vigorously assist to bring about that which we all admit to be so desirable.

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* It may be remarked here, that care should be employed by painters in the selection of glass for their works. Glass, as now made for ordinary purposes, is ill-suited for painting on. A few years ago, admirable glass for this object was obtainable from a factory at Dumbarton, which is not now in operation.

MEDIEVAL ARCHITECTURE IN FRANCE.—No. 2.

(Continued from page 145.)

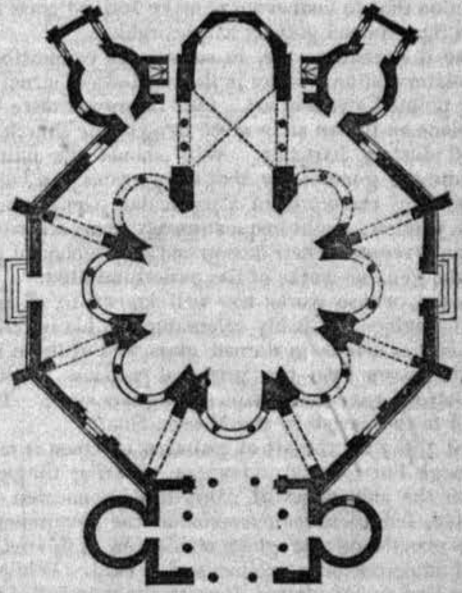
BYZANTINE STYLE.

Throughout a great part of the existence of what is called Gothic architecture, the Byzantine style flourished in France, both in distinct monuments, and as influencing other styles. In order to appreciate the character of this influence, we have considered it necessary not to limit ourselves to the examples afforded by France, seldom pure, but to investigate its history in other countries, so that thus we may be enabled to see the extent to which it has acted on other schools of art. It must be recollected that it was not until the eleventh century that the Greek and Latin churches were completely separated, while, during the whole period Constantinople contested with Rome for the supremacy. Down to that epoch Constantinople might be regarded with more propriety as the common centre of the Christian church than Rome, most of the general councils being held in the eastern empire, which was the great seat of learning. The bishops of Rome and Constantinople long contended for the jurisdiction over the provinces to the north of the Danube, and that the Greek patriarch was not without his influence, may be seen in many of the monuments to the north of the Alps. In France and in Germany, the examples of the Byzantine style are only partial, but in the Slavonic countries it is the predominant type to this day.

PLANS.

The first portion of the subject to which we shall call attention are the dispositions adopted in the arrangement of the ground plan of eastern churches, which, as was seen in the preceding article, completely altered the system copied from the Roman temples. Eusebius, in his life of Constantine,* describes some of the principal churches erected by this emperor and his mother in different provinces of his dominions. They were mostly circular or octagonal, and surmounted by lofty domes. Thus was constructed the great church of Antioch, dedicated to the Virgin, and called the Golden Temple, erected by this prince in the twenty-second year of his reign; it was in the form of an octagon, surrounded with exedræ and chapels. In the exedræ and in the porch it was lawful to bury. The church of the Ascension, built by St. Helena, mother of Constantine, upon the Mount of Olives, was circular, as is proved by the plan drawn on wax in the 8th century, and engraved in the *Acta Sanctorum*. This temple and the church of the Holy Sepulchre, are the reputed types of several churches built by the crusaders in their native countries. The churches of St. Marcellin and St. Constantius at Rome, are similar in their arrangements and were surmounted with cupolas of stone or pottery like the Syrian monuments before mentioned.

Fig. 6.—Church of St. Vital at Ravenna.



One of the nearest approaches to the description of Eusebius is the church of St. Vitalis, at Ravenna, founded in 534, while that city was still the seat of the Greek exarchs. Its plan is that of an octagon having semicircular chapels and *exedræ* on several points of its perimeter, or it may be described as round outside and octagonal within. A gallery on the first floor, running round the central area, is the *gynecæum*, or gallery for women, who, in the primitive church, as in the eastern churches to this day, were separated from the rest of the congregation. A hemispherical cupola, raised a great height from the ground, covers the building, and lights it by means of windows cut in the base. Pendents or brackets support the vault at the points where the re-entering angles of the polygon prevent it from being placed directly on the wall. The Greek architect, in constructing this building, has had recourse to a system, of which this is an early example.† Feeling the necessity for extreme lightness, since the cupola is supported mainly by brackets, he has used pieces of pottery in the shape of a bottle without a bottom. These vessels, placed in contact, form first the base of the cupola, then the curve, being continued without interruption, and in spiral, until they reach he top. The inside, as observed in our last number (p. 144), is covered with cement, decorated with mosaics on a gold ground. To the round churches of France we have already alluded at p. 143.

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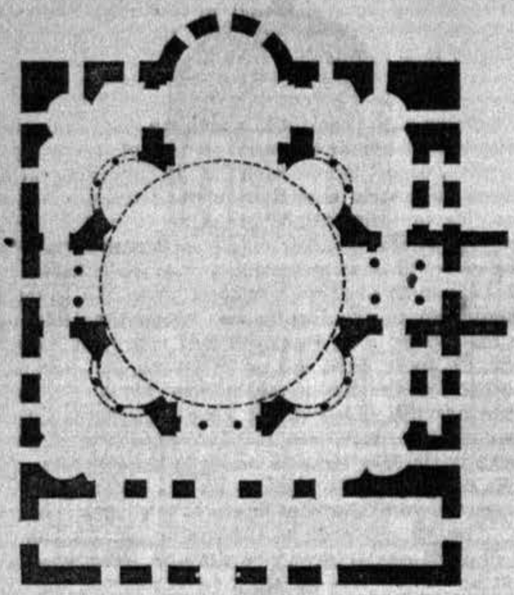
* Eusebius, Vita Constantini, l. iii, c. 50; and Abulfareius.

† Another is to be found in the octagon baptistery at Ravenna, built in 540.

Fig. 7.—Church of Sergius and Bacchus at Constantinople.



We now proceed to consider the works of a later date, from the 6th to the 13th century, when we come to the church of Sergius and Bacchus, now called by the Turks *Chutchuk agia Sophia*, or Little Sancta Sophia. This was built by Justinian, as was the large church of Sancta Sophia. The architects were Anthemius of Thrales and Isodore of Miletus. In the central area the plan is the same as at Ravenna, the same polygon and the same semicircular arrangements; on the first floor is the *gynecæum*, running round the nave. Like the church of Ravenna, it is adorned with columns of valuable stone, surmounted with Byzantine capitals. The whole is covered with a cupola. A modification is, however, introduced into the plan; the exterior is a square, enclosing the central octagon. The church of Sancta Sophia is also square externally, and the arrangement of the interior preserves all the leading features of that of Sergius and Bacchus. The example of Sancta Sophia affected art everywhere, and the square system was adopted in every part of the east, to the exclusion of the circle and the octagon. The two succeeding engravings, Figs. 8 & 9, of the Panagia Lycodimo, and Cathedral at Athens, illustrate this. The Panagia Lycodimo is towards Mount Hymettus, on the west of the city; the Cathedral is now the public library.

Fig. 8.—The Panagia Lycomido at Athens.

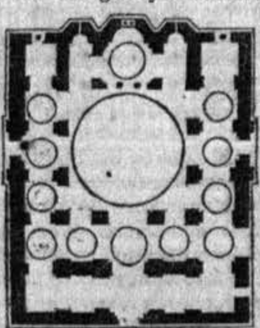
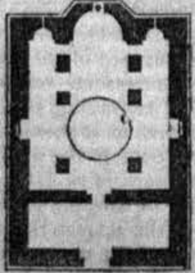


Fig. 9.—The Cathedral of Athens.

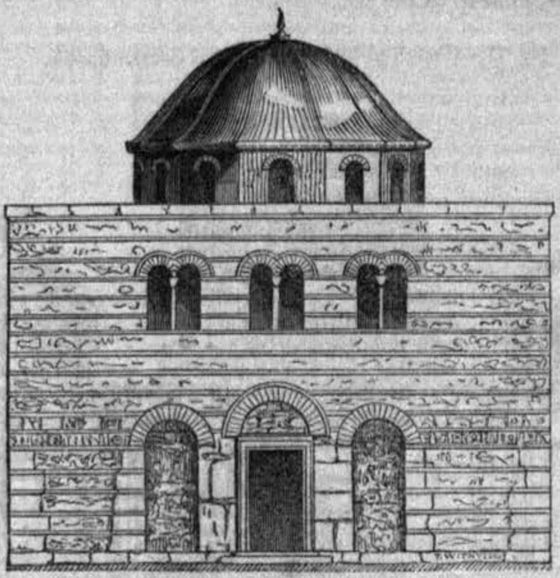


The plan of the *Ecs Miazin*, or the Three Churches, at Erivan, in Persia, one of the most celebrated Christian monuments of Asia, published by Chardin in his Persian travels, resembles the Cathedral of Athens. The only difference is in the form of the *narthex* or porch, which is square and open on three sides, whilst generally the vestibules occupy the whole breadth of the building. The *Ecs Miazin* has also a salient *absis* on each of its two lateral faces.

We may observe that it is from these models the Turks have borrowed the form of their mosques. Thus, also, they adopt a *Temenos* or square area isolating the building, and on the boundary of which are the residences of the officiating ministers and the tombs of their predecessors.[*]

ELEVATIONS.

Fig. 10.—Front of the Panagia Lycodimo at Athens.



The earliest Greek churches have a very simple front, a large mass, bounded at top by a horizontal line, without any pediment to indicate the inclination of the roof, carpentry not being used in Byzantine architecture, as cupolas and terraces only were used to cover in the building. Eusebius,[†] describing the basilica of the Apostles, says that rails cut out of gilt bronze were used to decorate the upper terrace, called the *Solarium*. It may be supposed from that, that the faces of the building were surmounted with horizontal cornices. The churches of Sergius and Bacchus, of Sancta Sophia, and of the Panagia Lycodimo (represented above), are all of the same kind; the square form being apparently preserved as late as the eighth and ninth centuries. These Byzantine churches are badly crowned, the upper entablature being composed only of a few mouldings, in which bricks are so placed as to form salient angles, and through which gutters are cut at different distances to carry off the water from the terraces or domes.

The first floor is generally marked on the front by a certain number of windows lighting the *gyneceum*. In the church of Sancta Sophia these windows are of large dimensions, semi-circular, and divided into three parts by two columns, which hold thin slabs or plates of stone, pierced with holes to let in the light.

Under the windows of the first story, or women's gallery, are placed the doors giving admission to the *narthex*, or porch. These doors are generally formed of lintels and door-posts, ornamented with elaborate mouldings, much in the style of the antique. Over the lintel a full arch, sometimes of stone and sometimes of brick, protects the door from the pressure of the superincumbent structure. The *narthex* was the place devoted to the catechumens, but in some of the later edifices it was used as a *gyneceum*, and thus the men entered the church by the north and south doors (*Noteiomeros, Boreiomeros*).

The early Byzantine basilicas have only a single dome, as in that of

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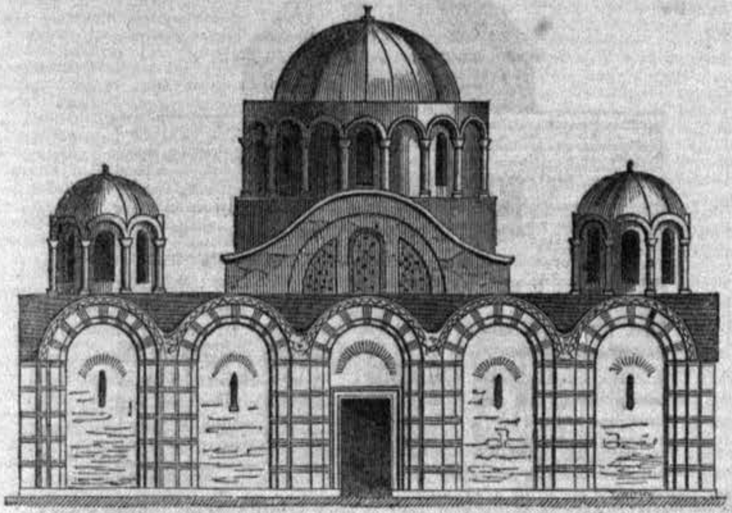
[*] Around the temple was a large space, on each of the sides of which were raised porticoes, connected together. Besides the basins (for purification) of the basilica, there were the habitations of the guardians supported by the porticoes, which they equalled in extent."—Eusebius in the Life of Constantine, l. xiv, c. 58, describing the Church of the Apostles, built at Byzantium by Constantine. We may, perhaps, find here the origin of the monastic cloister attached to our cathedrals.

[†] Eusebius, l. iv. c. 58.

Sergius and Bacchus at Constantinople. Sancta Sophia, in the same city, has a large central dome, and two semi-cupolas which cover the two curved portions situated to the east and west of the nave. These primitive domes are generally very heavy and cumbrous in form, differing from those which were erected later and elevated on tambours. A great number of small arched windows, very near each other, are cut through the base of the domes, and serve to light the interior. The effect of the light is so brilliant, that the cupola seems as it were isolated from the building. The cupola of Sancta Sophia, upwards of 120 feet in diameter, not being properly poised over the four main piers, in consequence of gathering the spandrils into too small a compass, exhibited, in less than 25 years, symptoms of approaching downfall, and the piers were accordingly strengthened on the outside.

Eusebius, Paul the Silent, and other authors, agree in describing the dome of the Church of the Apostles as being covered with dazzling gilt bronze, to keep off the rain.

Fig. 11.—Church of Mone tes Koras at Constantinople.



Another system of decoration succeeded this, and was much copied in Europe, as may be seen in St. Mark, at Venice, begun in 996. In this system the horizontal line, as bounding the front, was entirely given up, and was replaced by an arched line marking the extrados of the vaults. In the Greek islands are to be commonly seen, little chapels with a cradle-like roof covering the only nave, and secured with cement or sheet-lead. Where the building consists of several aisles, as most of the large Byzantine edifices at Constantinople, the roof has a festoon-like appearance, like so many round-covered trunks placed side by side.

Thus the exterior shows, as it were, the skeleton of the building, every series of arches in the building having the extrados delineated outside. So in the church of *Mone tes Koras*, (the House of the Virgin,) at Constantinople, represented above; the front consists of five great arches, and as another lateral series of arches runs across to form the *narthex*, this portion of the edifice is terminated at each end by one of these arches.

The domes which were erected at this period were more hemispherical, and the windows instead of being in the base of the cupola are formed in a tambour or cylindrical base, on which it rests. At this period too the domes began to increase in number and be added to the grand one forming the centre of the cross. In the church of the Pantocrator they crown the transepts and the anterior part of the nave, in that of St. Theodosia, now the mosque of the Rose, in the Fanar, the port of Constantinople, four secondary cupolas of the same form as the central one, but smaller, are raised at the four corners of the building. In some a dome is raised on the *narthex* as in the churches of the Pantocrator and Mone tes Koras. That of the Theotocos, near Solimanieh, has three placed symmetrically, one in the centre, and one at each end. The capitals of the columns in the Greek churches were placed on round shafts, and were little more than square blocks, tapered downwards, and adorned with foliage or basket work.

About the time of the Venetian Conquests began a union of Byzantine and Roman architecture, which is not one of the least curious forms of the style. Here is again restored the influence of the west, and pediments indicate the inclination of the roof, although the Greeks never used carpentry in their ancient churches. One of the finest examples of this period is the *Ecs Miazin*, a Christian temple of Erivan, published by Chardin, and more recently by M. Dubois. Of this style is also the building which down to 1827 was used as the cathedral of Athens.

Fig. 12.—Cathedral of Athens.

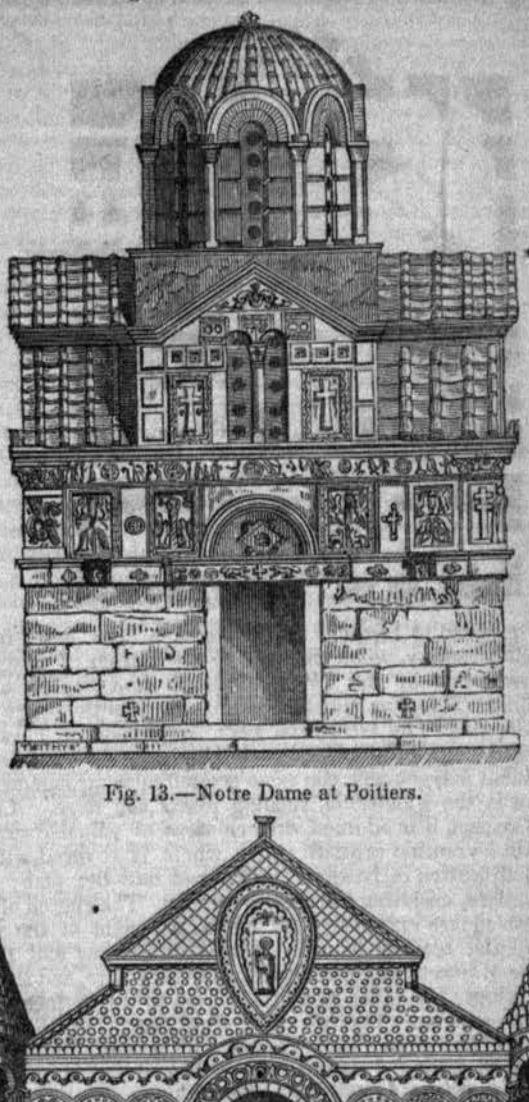
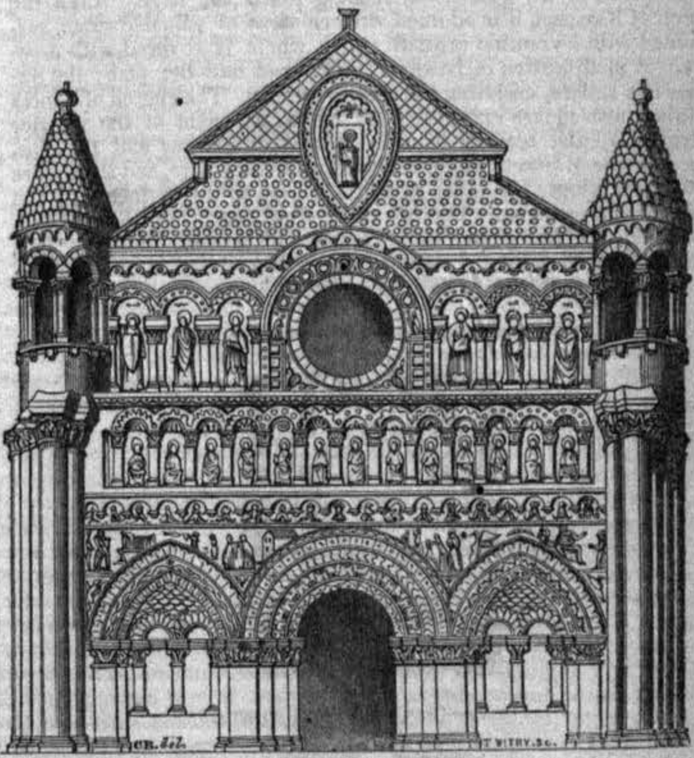


Fig. 13.—Notre Dame at Poitiers.


GR. del.
T. VITRY. Sc.

The figure above although partaking largely of the Roman, yet shows to what an extent the influence of the Byzantine school was felt, though in this case the interior presents much more points of resemblance than the outside. Our engraving, it must be observed, represents Notre Dame at Poitiers, not as it now is, but as it was before the gallery was broken through to enlarge the great window. This gallery although a type of the Gyneceum, is so far from being spacious, that in very few cases in the west of Europe, is there any communication through it. At Toscanella in the Roman States, and in the cathedral of Pisa, the original form is however preserved.

(To be continued.)

EXHIBITION—ROYAL ACADEMY.

(Continued from page 189.*)*

Among the practical jokes played off by the hanging committee in the architectural room, is that of placing a bird's-eye view where one must first get up a ladder in order to look down upon it, or in fact to look at it at all: which is no doubt exceedingly waggish and droll, but carrying the joke rather too far—at all events far above our heads; not that we care about it, because we have no relish whatever for drawings which carry us up into the clouds, in order to show us buildings as they would appear, viewed from a balloon. In itself the circumstance may be of little or no moment as far as the subject so placed is concerned, but it is certainly odd to meet with such blundering doings within the walls of a Royal Academy; where it certainly does bespeak a reprehensible systematic inattention to every thing connected with architecture. Lest we ourselves, however, should here be accused of inattention to our subject, we will resume our task of criticism by noticing two designs which we can heartily commend, and one of which we are glad to perceive is about to be executed. They are Nos. 1030 and 1050, both by Mr. J. W. Wild, and both for churches; the first being the "New Church, Streatham," to be executed under his superintendence; and the other a "Design for the Church proposed to be built at Paddington." They are neither Gothic nor Norman,—though the application of the round arch assimilates them somewhat to the latter; but in a style which has far more of the Lombardic character, and which, as shown is marked by picturesqueness no less than by simplicity, owing to the unusual breadth of surface and fewness of parts, on which account the Streatham church more particularly forms so striking a contrast to the impoverished, yet would-be-fine structures of the kind that have sprung up of late years in and around the metropolis, differing more or less from each other in their patterns, but all pretty much on a par as to taste, and exhibiting the same jog-trot outline system in design. Here we have at least some freshness of ideas and of mode of treatment,—a departure from the hackneyed track, into a better and more artist-like one. Of course we can speak only as to general character of external design and style, for the perspective allows us to see only fronts of the two buildings distinctly, consequently we cannot undertake to say whether their character is satisfactorily kept up throughout: neither can we judge very accurately as to dimensions. The composition of the façade of the first-mentioned of the two designs, is quite Lombardic in outline and arrangement, being divided into three compartments, the centre one of which rises higher than the other two, and terminates in a gable, while the side ones are covered by half gables, not forming continuations of the principal one, but terminating lower down, before that commences. In each compartment is an arched recess or porch, containing—if we mistake not, a square headed door; and above the centre entrance is a large circular or rose window filled with two intersecting triangles, and bordered with coloured rays around its external margin. This polychrome effect is intended, we presume, to be produced by brick-work; and if so, we question if it will prove altogether so pleasing in execution as it does in the drawing, because in the latter it is particularly soft and delicate, whereas both the hue and texture of red brick, even when of superior quality, do not recommend as a material for ornament, however suitable it may be in certain styles, as a ground for embellishment in stone-work. Still though we have great doubts as to the result, we will not prejudge the experiment; on the contrary, we shall be glad to discover that our *misgivings* are *mistakings* also.

The church proposed for Paddington is similar to the other in style, but of a more ambitious character, being apparently considerably more extensive, unless the parts themselves are upon a smaller scale, and being surmounted by a cupola on an elevated tambour at the intersection of the transepts. Putting cost out of the question, it was most probably this latter circumstance, combined with the unusual and not particularly English physiognomy of the whole, that caused this design to be rejected incontinently. Perhaps, too, it may have been considered exceptionable as having too Roman Catholic a look,—for Catholicism happens to be just now one of the pet bug-bears of the day; just as if, while it is losing ground everywhere else, it is likely to gain ground in the land of John Bullism. We know not who is to be the architect of the church at Paddington,—have not, in fact learned if an ultimate decision is yet made, but the building will, we apprehend, not startle us by architectural innovations.

Turning from Mr. Wild's drawings to one for a similar purpose, No. 992, "The *approved* design for the New Church now about to be erected in the Liberty of the Rolls," we may tolerably plainly see what kind of things suit the taste and notions of those who are entrusted with the power of deciding on such occasions. That 'approved' does not exactly mean the most worthy to be approved, or carry with it an idea of superiority is evident enough—at least to ourselves, and in the present instance because we happen to have seen two other designs sent in for the same building, either of which was immeasurably better than this approved one; therefore it is a piece of good luck for it that neither of them are here exhibited, else we should most assuredly enter into some very 'odorous' comparisons. Perhaps, too, it is another piece of good luck for No. 992, that it is hung so high up as to be likely to escape notice altogether, unless the descriptive title in the catalogue should cause it to be hunted out.

No. 1034, Messrs. Buckler's "Design for the West Front of the Roman Church of St. George, Southwark," is in no danger of being passed by unnoticed, because the intense—and for this climate unnatural blue of the sky, renders it too conspicuous. As to the design itself, his front consists only of a very lofty tower in a style of Early Gothic, and although of good character, did not strike us as particularly novel or tasteful.

Nos. 1037 and 8, show us Mr. S. Smirke's design for the Reform Club House, in an elevation of the side towards Pall Mall, and a perspective view including that and the West end of the building, with its portico. Although merely said to be for "a Club House," there can be no doubt as to the particular one for which it was produced, both because it agrees with the description given of it in our first volume, (page 68), and as the Travellers' and Athenæum Club-houses are seen adjoining it. Most certainly it is not such as to make us regret that it was not preferred to Mr. Barry's, still we do not agree with the 'Art-Union,' which terms it "an ordinary Italian residence, with an ugly Corinthian portico tacked to the front of it." Now whether the epithet ordinary is to be understood as signifying 'usual,' or as expressive of both meanness and common-place character, we do not think it very correctly applied, because, although it may in some respects be in rather questionable taste,—we allude to the mullioned and transomed *croisées*,—it is more than ordinarily ornate, and is stamped by a good deal of picturesque quality. We prefer it greatly to the façade of the Oxford and Cambridge University Club-house, by the same architect, it being treated with more of artist-like feeling, and with greater consistency also. As regards the Corinthian tetrastyle of the West front, we do not pretend to say that it is particularly classical, but its effect in the composition is decidedly better than many of our soi-disant classical things of that kind which are tacked to buildings by no means so good as even "an ordinary Italian residence." Most decidedly too we prefer this to such a piece of architecture as No. 1045. "Design for the Taylor and Randolph building at Oxford," which as far as we can make it out where it hung, seems to us to evince neither originality of any kind, nor even study, both the composition and detail being exceedingly tame and common-place; yet we ought not to speak too peremptorily, because the 'Art-Union' critic tells us it possesses "much merit," further than which, said deponent sayeth nothing, but leaves others to find out, if they can, wherein it consists.

(To be continued.)

ON EXCHANGES.

We present our readers with a brief sketch of a lecture delivered at the the last conversazione of the Architectural Society, by its President, William Tite, Esq., F.R.S., upon the subject of the origin and history of that class of buildings denominated "*Exchanges*;" a subject which has just claims not only to the attention of the public, in an empire of such commercial importance as our own, but more speficically so to the examination of every architectural student, in an age when both at home and abroad, the rapid progress of improvement may be reasonably expected to provide opportunities for the erection of Exchanges as well as palaces and churches.

In introducing his subject by a reference to the state of society in the most remote ages, Mr. Tite observed that the extensive commercial relations of such ancient cities as Tyre, and the vast conflux thereto of mercantile men from all quarters of the known world, render it a matter of little doubt that some place of public assemblage must have been allotted to their especial use. This seems rendered yet more probable, when we observe to what arrangements precisely similar circumstances gave rise, though at a later period, among the Greeks and Romans. It is clear that the αγορα of the former, and the forum of the latter were alike applied indifferently to various public purposes. Sometimes they were used for meetings of a commercial character, as well as for the ordinary purposes of the market place; sometimes for the administration of the laws, or the celebration of games and festivals; and sometimes for places of deliberation upon municipal affairs.

As the number, wealth, and employments of the inhabitants increased, it was found inconvenient to have so many occupations carried on together, and two classes of fora were established, viz. Venalia or market places, properly so called, and Civilia, or places of assembly, of which, however, there was but one until the time of Julius Cæsar. The Venalia were again divided into the Boarium or ox-market, the Piscarium, or fish-market, and the like. Something resembling this separation and improvement is to be traced in the history of the establishment of the English courts of law. The Saxon constitution comprehended but one superior court of justice in the kingdom, viz. the Great Council; but, after the Norman invasion, the ecclesiastical jurisdiction was separated from the civil, and the king subsequently effected another separation between the judicial and the parliamentary power, vested in the remaining members. He then established that very comprehensive court in his own residence, called "the King's Hall," composed of the great officers of state; which became at length divided into the different courts of Chancery, Exchequer, Common Pleas, and the Earl Marshall's court, or Court of Honour. The simple features of a Roman Forum appear at once to convey the image of a modern Exchange, it having been an open area surrounded by a colonnade, about which were subsequently established temples and prisons, courts and record offices, public granaries, offices of money changers, and a variety of trades, the municipal treasuries, and the rostra whence orators addressed the people. Some differences existed between the Greek and Roman Fora, derived from the different uses to which they were to be applied. Those of the Greeks were built square, with the columns near together, to afford as much shelter as possible; above which was an upper ambulatory or gallery for walking. The Roman fora, on the contrary, were oblong in the area, having the columns set at considerable intervals, but still surmounted by the gallery, in which latter feature, also, they somewhat resembled the Bourses of the 16th and 17th centuries. In those places which lay inland, the Forum was erected in the centre of the city, but in marine towns it was situated at the port. Accordingly the Piræus, or maritime town of Athens, was the principal place of commerce connected therewith, and it contained temples and theatres, arsenals, granaries and shops, and also the established place of assembly for merchants.

These circumstances are curiously illustrated by Theophrastus, in a description of the character of an ostentatious Athenian merchant, ‘εν τῳ δειγματι ‘εστηκως, and vaunting of his enterprise and wealth; in which description it is supposed by Casaubon and others, that the δειγμα expresses the place where samples of merchandize were produced and examined.

Down to this period, and most probably to a much later time, the places of assembly for merchants were to be found in the forum; and they appear to have generally occupied that interior extremity called the Basilica, for the choice of which, perhaps, Vitruvius gives one of the original reasons several centuries after, when he says, "the Basilica should be adjoining to the forum on the warmest side, that the merchants may confer together without being incommoded by the weather." Another cause for the selection might possibly be that they were there completely removed from the noise and confusion of the rest of the market or forum.

Livy also alludes to the formation of a "collegium mercatorum," in the fifth century before the Christian æra; but it may be doubted whether this phrase of itself can fairly be considered as proving any thing more than the existence of a "fraternity of merchants." It will be proper also to observe, before dismissing all notice of that period of remote antiquity, that there were certain secular points of view in which the Temple at Jerusalem may be taken as affording an illustration of this subject. The first Temple, it will be remembered, consisted of several square courts, surrounded by colonnades and chambers; and this building was an extended and greatly improved copy of the tabernacle, to which, therefore, may be referred the remote original of that extremely natural and convenient form for places of public assembly, which were subsequently to be found throughout the whole of the civilized world. When the corrupted traditions of the Hebrews led them to misemploy and profane the second temple, by making it a place of merchandize, the resemblance between the court of the Gentiles and a Roman Forum was very remarkable. After the conclusion of the feast of Purim, in commemoration of the triumph of Esther and Mordecai, the money-changers considered it lawful to seat themselves in the outer court, to exchange foreign coins for such as were current at Jerusalem; for the temple tribute, though collected in heathen money, was required to be paid in the shekels of the sanctuary, and several offerings also required the addition of parts of shekels to make them complete.

In this last circumstance, it will be shown hereafter, that there may be an especial parallel found to the facts that probably gave rise to the disignation of our own edifice of London. The court of the great temple at Mecca, as decribed by Sale, and many of the eastern Khans or Caravanserais will furnish some additional illustration of the forms of buildings applied in later ages and other climes to mixed purposes, not dissimilar to those under consideration.

From precedents such as these it may have been that the Venetians, in more modern times, but during the earlier ages of their republic, obtained a model for their great Exchange on the Island of the Rialto. It will be observed that this place of mercantile concourse was not the celebrated Bridge of the Rialto, as is usually imagined, but a portion of the Island of that name immediately adjacent to the Bridge. This island appears to have been the first inhabited among the many that now constitute the City of Venice; it became the centre of commerce, and the vast depository of the most valuable merchanize of all nations. As described by Sabellico in the year 1492, it appears that nothing was wanting to the completeness of this site, not only for mercantile, but for municipal purposes. The great place of meeting was a spacious quadrangular piazza, almost surrounding the church of St. Jacopo; and in its immediate vicinity were warehouses, banks, shops, markets, public offices, and halls of every description. The greater portion of these buildings was destroyed by fire in 1515, but was rebuilt, in a style of superior magnificence, during the following nine years, under the architectural superintendence of Antonio Scarpagni.

Passing by other Italian structures of inferior note, raised for the same objects, we shall find the example derived from them followed with conspicuous splendour in some of the cities of the Netherlands. To meet the rising commercial importance of Antwerp, at the beginning of the 16th century, a Bourse (according to the name introduced from Bruges), was erected in the year 1531. This structure is 180 feet in length by 140 in breadth, and is supported by 44 stone pillars, which are differently sculptured. It contains numerous subterranean warehouses, over which are the halls occupied by the tribunal and the chamber of commerce. It was not until nearly 40 years after this period that England possessed any similar building, during all which time the merchants were accustomed to assemble twice in each day, in the open air in Lombard-street. The king himself, however, so early as 1535, proposed that they should remove to the old edifice of Leadenhall, which they declined doing; and in 1537 Sir Richard Gresham laid before Thomas Cromwell, then Lord Privy Seal, the plan of a Bourse for London, in the old resort of Lombard-street, to which he had been probably incited by a visit to Antwerp. Before retiring from his Mayoralty in the following year, he made another effort to complete this design in a letter to Lord Cromwell, which is still extant. He states therein that "it will cost £2,000 and more," and at the same time shows the real cause why the work was not then and there carried into effect; since he adds, "there is certain houses in the said street belonging to Sir George Monnocks, and, except we may purchase them, the said Burse cannot be made. Wherefore, may it please your good lordship to move the King's Highness to have his most gracious letters directed to the said Sir George, willing, and also commanding him to cause the said houses to be sold to the Mayor and Commonalty of the City of London, for such prices as he did purchase them for, and that he fault not but to accomplish his gracious commandment. The letter must be sharply made, for he is of no gentle nature; and, that he shall give farther credence to the Mayor, I will deliver the letter, and handle him the best I may: and, if I may obtain to have the said houses, I doubt not but to gather £1,000 toward the building, or I depart out of mine office. There shall lack no good will in me."

The project which thus originated with Sir Richard Gresham, was realized by the liberality and enterprise of his son Sir Thomas, who commenced his edifice in London in the year 1566. The similarity which subsisted between this building and that of Antwerp, was very conspicuous. Like the latter, the Exchange of London had a tall tower placed on the east side of the principal entrance, containing a bell, which twice in the day summoned the merchants to assemble, at noon, and at six in the evening. In the interior of both we observe the same quadrangular arcade, carrying a similar upper story, and surmounted again by a high roof and regular gabled dormers of the same character. The Royal Exchange received its name on being opened in person by Queen Elizabeth, on the 23rd January, 1570-71.

There does not appear to have been assigned, either by contemporaneous or modern authority, any reason for the change of the name of this edifice by the Queen; though, from the very time of the proclamation, it seems to have been most effectual and complete. If, however, at this very distant date, a conjecture may be offered, it might have been a design of Elizabeth, which was never brought to maturity, to have re-established, in this building, the ancient exchange of the sovereigns of England, the former situation of which remains commemorated, even at the present day, in the street in Cheapside called *Old 'Change*. It was here that one of those ancient officers known as "the King's Exchangers" was placed, whose duty it was to attend to the supply of the Mints with bullion, to distribute the new coinages and to regulate the exchange of foreign coin. Of these officers there were anciently three, two in London, at the Tower and Old 'Change, and one in the city of Canterbury. Subsequently another was appointed with an establishment in Lombard Street, the ancient rendezvous of the merchants; and it appears not improbable that the Queen's intention was to have removed this functionary to what was now pre-eminently designated as the Royal Exchange.

As the Bourse of Antwerp had furnished a model for close imitation to the projectors of London, the work of the latter was, in its turn, closely followed by the citizens of Amsterdam. The Bourse, which still subsists there, was commenced in 1608, and opened in 1613. A rectangular area, as in the previous instances, is surrounded by a covered way, formed by forty columns of stone, carrying an upper story and roof exceedingly similar to those before noticed. There are principal entrances on the north and south sides, and the latter has the addition of a lofty bell-tower and clock.

To revert to the Royal Exchange of London, it may be noticed that, the original structure having been destroyed in the great fire of 1666, its successor was erected upon the same site, under the superintendence of Mr. Edward Jerman, one of the surveyors to the city, at an outlay of £58,962. With the facts affecting the recent destruction of this edifice by fire also, we are all too well acquainted; and with respect to the erection of any structure that may supply its place, it may be sufficient just to state, in conclusion, that the instructions under which the various designs for a new Royal Exchange have been prepared, have determined that an open area shall be preserved for the use of the merchants, after the manner of the former building, but about one third larger in extent. The Bourse at Paris, the more recently erected Exchange at Glasgow, and the Exchange at St. Petersburg, are all covered buildings. The Exchange at Liverpool, on the other hand, follows the more ancient precedent, retaining the open area and surrounding arcade. As any discussion of the propriety of those instructions that have been issued for the direction of architects on the subject of the new Royal Exchange, would be beside our present purpose, as would any observations in anticipation of a future structure, we may now close our remarks, with a hope that this compressed statement may afford our readers some degree of that interest with which the original lecture was received by the audience of the Architectural Society.

THE ROYAL EXCHANGE.

Sir,—Having taken no part whatever in the competition, or in any of the correspondences which have appeared in the various public prints relative to the Royal Exchange, and feeling a general disgust at the intemperate manner in which such correspondences are usually conducted, but understanding that the affair appears as far off from settlement as ever, I now crave through the medium of your widely circulated journal, the promulgation of the following brief remarks.

1st. It appears pretty certain, that the plan which will be adopted will conform, as it should, to the lines of the principal adjoining streets, otherwise the frontages of the building would lie awkwardly with regard to them, and more ground would be given up in making the site rectangular than the required accommodation would well allow. It seems therefore that the plan will be in shape a trapezium.

2nd. In all plans of this shape which I have seen, (that of Mr. Tite included), there are a multitude of irregularities, many rooms out of square, some of the largest of them with whole wings sliced off irregularly, and many doors, windows, and chimneys seemingly placed at random, all which defects would be evident enough to those who might use such apartments.

3rd. Now I would undertake to make such a design (merely by remembering that there is in the world such an art as Geometry, of which Wren, and his kind, made much use, more especially in difficult cases), which design should have every internal apartment, angle, door, window, and chimney regular.

4th. To effect this, I should need only to cut off from the site, the large ranges of apartments in lines exactly parallel to the principal front of the building. This would leave a smaller trapezium in the centre of the ground.

5th. Within this smaller trapezium I should place an elliptical court, and in the four spandrel spaces which would be left, I should place semi-circular staircases, water-closets, and other offices.

6th. The architecture of the elliptical court, I should form something after Inigo Jones's magnificent and universally admired circular Persian court, designed for Whitehall: but instead of having all the columnar statues (say 32 in number) made similar, which by monotony would displease, I would have them each a type of some chief nation trading to London: and if the expense of these Caryatic statues be objected to, I doubt not that the merchants engaged in the several trades, would find the difference between the price of them and of plain piers.

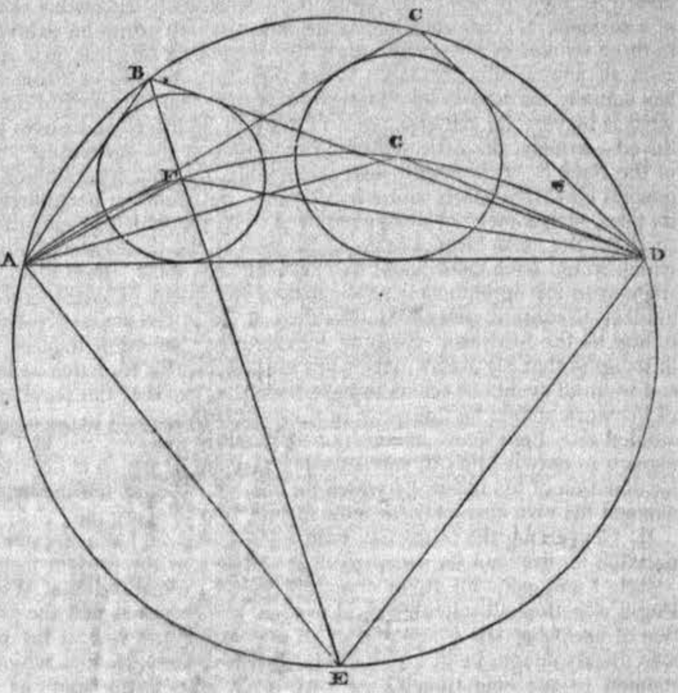
I am, Sir, your very obedient humble servant,

Gray's Inn, June 19, 1840. B.

GEOMETRICAL THEOREM.

Sir—I believe that the following curious property of a circle has not hitherto been noticed; or if it has, I am not aware of its existence in any of our works on Geometry.

Let A B C D E be a circle, of which A C D is any given segment: Let any number of triangles A B D, A C D, &c. be drawn in this segment, and let circles be inscribed in these triangles: their centres F, G, &c. are in the arc of a circle, whose centre is at E, the middle of the arc of the opposite segment A E D.



DEMONSTRATION.

Join A F, F D, A G, G D; then since F is the centre of the circle, inscribed in the triangle A B D, the lines A F, F D, bisect the angles B A D, B D A. (Euc. B. 4, P. 4). For a like reason A G, G D, bisect the angles C A D, C D A; hence the angles F A D, F D A, together, are equal to half the angles, B A D, B D A together, and the angles G A D, G D A together, to half the angles C A D, C D A together. Now the angles A B D, A C D, are equal (being in the same segment), therefore the angles B A D, B D A together, are equal to the angles C A D, C D A together, and as the halves of equals are equal, the angles F A D, F D A together are equal to the angles G A D, G D A together; that is in the two triangles A F D, A G D, two angles of the one, are together equal to two angles of the other, and therefore the third angle A F D, is equal to the third angle A G D. The same reasoning will prove, that all angles similarly circumstanced to A F D, are also equal to A G D: therefore, the points A, F, G, D, are in an arc of a circle.

Join B F, and produce it to cut the opposite circumference in E and join E A, E D; then because the angle A B E, is equal to the angle D B E, the segment A E, is equal to the segment E D, and the chord A E, to the chord E D. Again the angles A B E, E D A, are equal (being in the same segment), and by construction, the angle A D F is equal to the angle F D B, therefore the whole angle E D F, is equal to the two A B F, F D B, that is to the two F B D, F D B, that is to the exterior angle E F D; therefore the angle E F D, is equal to the angle E D F; consequently E F, is equal to E D, that is to E A. The same reasoning would prove E F to be equal to a line drawn from G, to the point E. Wherefore the point E is the centre of a circle, of which F and G, as also the centres of all other circles similarly inscribed, are in the circumference.

H. Spencer.

Birmingham and Gloucester
Railway Office, Worcester.

CANDIDUS'S NOTE-BOOK.

FASCICULUS XVI.

"I must have liberty
Withal, as large a charter as the winds,
To blow on whom I please."

I. A friend of mine is in the habit of exclaiming "Damn all Dictionary-makers," and I am tempted to say ditto as regards all illustrators, a set of illuminati who generally display their cleverness by leaving you as much in the dark as possible. Would it be believed that one of these 'picturesque' geniusses, who visited St. Petersburg 'expressly' for the purpose of taking views of the most striking buildings in that capital, actually turned his back upon the portico and dome of the Kazon Church, and brought into his view of that edifice merely an angle of one of the sweeping colonnades! Hogarth's sketch of a serjeant and dog entering an ale-house, which group he exhibited in three strokes of his pencil, might be taken as a satirical quiz upon such shamming illustrations. What then is to be said of Soane who has actually omitted in his 'Designs of Public and Private Buildings,' what is by very far the best piece of exterior architecture he ever produced—namely, the little semicircular loggia at the north-west angle of the Bank!! It is indeed just discernable in a coarse scratch of the general elevation barely an inch in height; but from the peculiarity of its plan, such a piece of design required to be explained by elevations, sections, &c. on as large a scale as the size of the plates would admit, which would have been about half an inch to a foot. That I am not singular in my opinion as to the merits of that piece of architecture is evident, because it was selected as the subject of the medal presented to him by the Institute. Such an extraordinary omission induces me to imagine that Sir John's wits were *benighted* quite as much as himself;—at all events he seems to have been resolved that the purchasers of his work should be left quite in the dark with respect to the subject alluded to. Poor man! he was not deficient in cunning, and had just enough to outwit himself, one notorious instance of which is his singular donation of his house, by which he has bamboozled the public, but damned his own character for munificence, into the bargain.

II. Conversing the other day with ——— (who has a greater reputation for wit than for sanctity) on the subject of the present fashion—style I will not call it, in church building, I remarked that Welby Pugin was after all tolerably right in some respects, and that the practice of enclosing the congregation in separate pews was an insuperable disadvantage in an architectural point of view, besides which it seemed to me objectionable as carrying wordly distinctions and the principle of *meum* and *teum* into the very House of God. "As regards architectural effect," replied ———, "you are certainly right,—in your other objection as certainly wrong. Do you not perceive the symbolic propriety and expressive meaning of the very things you find fault with."—"I really do not." "Why then, my good friend, you must have grown quite muddy-headed.—What!—do you not at once see the striking propriety—the analogical and practical illustration of Gospel, in putting the pastor into his pulpit, and his *flock* into *sheep-pens?*"

III. "It is most deplorable and paltry," observes Prince Puckler-Muskau, "when, instead of being expunged and corrected, a particular part which is evidently a failure, is allowed to remain a blemish to the whole work, merely because it has cost so much time and money, and the requisite alteration would cost so much more." Although the writer is here speaking of Landscape-gardening, the remark is equally applicable to architecture, many productions of which, might be greatly improved by amendments that are almost self-evident. It is true, there ought never to be any occasion for improvement of such kind, because every part and feature of a building may be, and invariably ought to be, thoroughly studied and foreseen from the designs for it.

IV. Earnestly is it to be wished that architects would endeavour to emulate the other sex in the devoted application of all their faculties, which those exemplary and most truly *con amore* artists bestow upon their handy-works. When I perceive on the one hand with what plodding indifference, hurry, or carelessness, many buildings have been designed; and on the other, what anxious thought, what patience, what contrivance, what ingenuity, what scheming and planning, and how much consultation, are given to devise a ball dress—as if it were a work destined to outlive the eternal pyramids;—when I perceive with what critical study and exactness every part of the fabric is elaborated, and that as much attention is paid to the precise quality and texture of the material, as if all men were men-milliners and able to tell at a glance where a lady's lace and velvet have been manufactured, or what they cost per yard;—when I see and perceive all this, I cannot help drawing a comparison that is greatly to the disadvantage of us 'male creatures,' especially of some of those who call themselves architects. What hurried, slovenly, and slobbered work do they make of it! in what coarse, ill-assorted, and awkwardly put on finery do they attempt to dress up their designs,—to say nothing of the grotesque mixture of arrant shabbiness and such finery which they so frequently parade before our eyes in the most ridiculous manner. We men are dull pedants who judge only by rules, while women are guided by a refined tact, an unerring delicacy of instinct, which preserve them from committing those gross solecisms in taste into which we are perpetually falling: let us therefore cry out *Place aux Dames!* for they deserve to take precedence of all the Old Women in Breeches, who bore us with their Vitruvius, and their Palladio.

V. Lindley Murray would go just as far towards making a poet, as the writings of Vitruvius, Palladio, *et hoc genus omne*, towards forming an architect who should also rank as an artist in his profession. For what are that class of architectural writers more than mere *grammatici*,—useful as furnishing the rudiments and implements of study, and nothing further? But it would seem that in architecture mere grammatical accuracy is held to be everything,—the ideas, the combinations, the conception, the composition—effect, character, expression, comparatively nothing,—what may be left to chance; because, provided no sins be committed against the petty rules of the art, be it as intolerably dull as it may, the work is certain of being recognized as legitimate and orthodox. Such being the case, and negative merit being accepted as possitive—nay as something wonderful, nothing short of a prodigious achievement in art, can we at all wonder at beholding so many sickly insipidities displaying themselves in stone or cement? or such pieces of architectural bathos, as the British Insurance Office, where Agrigentum columns ,shop windows, crooked balconies, figures of sprawling drunken ladies, &c., are all jumbled and squeezed up together. If the author of that monstrosity be still living, with what a shudder must he be seized every time he passes by it,—unless his nerves should happen to be of iron, and his scull well fortified with lead. However he has certainly given, at his own cost, an excellent lesson *pro bono publico* to the profession, showing them very forcibly what they ought to avoid.

VI. It was the opinion of that exceedingly sensible, but most horrible unsentimental person, Dr. Johnson, that "marriages would in general be as happy and often more so, if they were all made by the Lord Chancellor;"—which, by the bye, would be a complete death blow to the novelists:—and I myself am sometimes inclined to adopt a similar opinion with respect to architectural competitions, and say that in nine cases out of ten, the choice would prove as good were it left to the Lord Chancellor, or the—Lord Mayor. Seldom could their decision prove a worse one than what now frequently occurs; not often would it be so bad, because ignoramus as he might be, a Lord Mayor, would as an individual feel obliged to pay some deference to public opinion; whereas a committee can afford to brave it, since whatever may be the odium that falls upon it as a body, no member of it feels in his own person. As to the Lord Chancellor, however, I should be loth to commit the task of decision to him, because expedition and promptitude are not to be looked for in that quarter. In fact, the Royal Exchange does seem to have been actually put into *Chancery*; for after the lapse of two years and a half the foundations of a new structure are not yet laid, although the space of a single twelvemonth sufficed to rebuild, and refurnish the Winter Palace at St. Petersburg, an edifice three or four times the size of the one intended to be reared in Cornhill. The British Museum also goes on at the true Chancery pace,—*ditto* the Nelson Monument that is to be. Nay, if the truth may be told, Competition itself is a sort of *Chancery*, mere chance having quite as much to do with the decisions, as either judgement or taste.

VII. I incline to the opinion of Mr. Walter Fisher, when he says: "The real truth is, I feel mortified at being kept down by a want of ardour in our patrons. We hear a great deal of Scott and Southey, and Byron, and Wordsworth; and folks talk of Lawrence and Reynolds,—and all the rest of it; but what is poetry of which not one person in ten thousand can judge—to Cookery?" When I say I incline to Walter's opinion,—who, by the bye, if he does not lack conceit has an equal stock of enthusiasm.—I do not mean that I form precisely the same comparative estimate of poetry, painting, and cookery as he does, but merely agree with him that for one who can judge of poetry, there are ten thousand who can judge of and relish cookery,—and that there are ten times ten thousand who are most unaffectedly devoted to the latter, for who is passionately addicted to—architecture.

It is invidious to scrutinize motives too narrowly, but I have certain uncomfortable misgivings, that lead me to fancy architecture would have still fewer votaries were it not for the attractions of cookery. If the reader be so obtuse as to ask for further elucidation, I can only pity—not assist him, because it would be impossible for me to explain myself more clearly without becoming libellous, and forfeiting that character for indulgent clemency, and considerate forbearance which I have now established.—*Au reste*, it would be amusing if not edifying to draw a parallel between architecture and cookery, which latter of these two fine arts requires a peculiar genius for combinations, *combinations-geist*, generally dispensed with by the other. At all events it cannot be denied that architects do show themselves less expert than our *chefs-de-cuisine*, for they seldom do more than merely *hash up* afresh the same stale remains of classicality.

FRESCO PAINTING IN ENGLAND.

THE DUKE OF BEAUFORT'S MANSION.

We have several times alluded to the works going on at Beaufort House, but have not until now been able to give our readers any detailed account. We may remark that this mansion is situated in Arlington Street, Piccadilly, having, from the back, a view of the Green Park. It was formerly in the occupation of the Marquis of Camden, but is now being fitted up by the Duke of Beaufort as a town residence. His grace had certainly some difficulties to contend with in the previous state of the house, which, like too many other mansions in London, had been consigned to the tasteful hands of the upholsterer and the whitewasher. It being considered that painting might look as well on the walls as dabbed and spotted paper, a point on which we fear there are some doubts entertained by London residents generally, it was originally suggested, under the idea that Englishmen could not do it so cheaply and so well, that German artists should be employed. While the negociations were going on, Mr. Latilla was mentioned to the Duke as having been engaged in similar works, and having been directed to send in designs, was immediately employed. By this arrangement the work has not only been done much cheaper, and we think many will consider better, but a great service has been rendered to English art. Mr. Latilla's system of fresco painting had already met with much approbation and encouragement, but it wanted this excellent opportunity to display its powers more fully.

Passing on now to the works executed under Mr. Latilla's direction, the first is a vaulted corridor leading from the entrance hall, and which, in the Marquis of Camden's time, remained in all the simplicity of white and unpolluted paint, but is now designed in bigio or chiar' oscuro with trophies and medallions, something in the Roman style. On the side opposite the windows a range of plaster statues of agricultural divinities bear lights in their hands, and serve to break the view. At the end of this corridor is a hall from which a staircase runs to the upper apartments; the walls and ceiling of this staircase have also been decorated with representations of medallions and architectural ornaments.

On the ground floor are the principal apartments, one of which, the banquetting room, we are now about to describe. This apartment may be about thirty feet by twenty, and sixteen feet high, having on one of the long sides three windows, the opposite side an entrance door, another and a chimney at one end of the room, and at the other end folding doors leading out of it. Six large panels are thus left, which are painted with two series of subjects, one representing the seasons, and the other Hebe and Ariadne. As a banquetting room the decorations of course are of a Bacchanalian character, and without departing from the character of the antique, are not repulsive to modern taste. The whole style is a similar happy adaptation of ancient principles, and without being restricted to any one school, has a unity of character which establishes it as a style in itself. The design of the panels is much in the Pompeian taste, but carried out in accordance with the advance of modern art; the pilasters and arabesques have, perhaps, more of the character of Girolamo Romanino, or his model, the baths of Titus, and the tone of colouring shows a nearer approach to the Herculanean than the Pompeian. The ground of the room is of a lavender colour, and upon this a brightness and harmony of effect is produced without spottiness or rawness.

The two panels at each end of the room are devoted to the seasons, the first of which, Spring, is represented by a female figure clothed in white gauze, and floating in true antique style in ambient air. Beneath her is a landscape representing Greek scenery, and under the panel is a mask of a young head in a festoon of spring flowers, daffodils, crocuses, snow-drops, &c.

The next on the same side is Summer, also personated by a young female, crowned with a wreath of roses, and holding a garland in her hand, and floating over scenery representing Egyptian subjects. The festoon underneath is of roses and other summer flowers, and contains a mask of Baccnus.

At the opposite end of the room, the figure next the door, that of an older female, is the emblem of Autumn; she is crowned with poppies, and presides over an autumnal landscape. A mask of a warrior reposes on a festoon of grapes, wheat-ears, and other harvest productions. Part of the drapery of this is, perhaps, a little heavy.

The remaining panel of this series is devoted to Winter, a subject treated in a beautiful and effective method. In a deep blue winter sky floats a young female closely draped, with part of her robe brought round her head as a hood. Above her head is seen the constellation of the Pleiades, and to her breasts she clasps a cinerary urn, the emblem of the closing year. Underneath is a representation of iceclad mountains, forming an appropriate finish to this admirable scene, the character of which is indeed well maintained. A mask of a bearded old man is placed on the festoon beneath, which is twined of the holly and mistletoe and other emblems of Christmas.

The other and smaller series of subjects is on the side opposite the windows. One panel is appropriated to Hebe, who, with her golden vase and cup, and usual attributes, flies over a morning scene. The other panel represents Ariadne with the thyrsus, the scene under being a sacrifice to Bacchus. Under each of these panels is a festoon of flowers with a mask of a female head.

There is nothing much to remark in the smaller doors, they have over them each a small panel, containing a vase and flowers. The ornaments of the folding doors consisting of bluish ribbands and of medallions, have much of the character of the baths of Titus, and over the door is an arabesque on a yellow ground. The treatment of these doors is very skilful, the details made to tell well. The chimney and fire-place is of black marble with ormolu ornaments, and over it is a large glass. This chimney it was very difficult to bring in, but the treatment has been most successful. Over the glass is a deep chocolate ground panel, with boys carrying grapes, accompanying an infant Bacchus riding on a goat. The several compartments of the room are divided by arabesques, consisting of a red staff or thyrsus, with grapes and Bacchanalian emblems. The carving round the room has four corners of a peculiar deep brown used by the ancients, which Mr. Latilla names Etruscan brown. Between these are arabesques on a cream-coloured ground, consisting of boys playing with panthers. The ceiling is of a low cream colour, having in the centre a patera, formed of light festoons and flowers. From this depends a lamp ornamented with vine leaves of ormolu, and grapes of ground glass. The carpet is of a plain pattern, and light in appearance; it is of blue and yellow on a maroon ground, with a white border. The furniture is of the simplest description, a mahogany table and red morocco chairs. These latter accessories are not of the selection of the artist, but it does great credit to the high-minded nobleman who employed him, that he has not, as is too often the case, allowed the furniture to injure the rest of the works. The lamp might have been more in the antique, but it is not offensive. An Elizabethan stove, intended to have been placed in the room, has been removed.

An oval saloon leading from the banquetting room to the drawing room is also painted by Mr. Latilla. It has a white ground with festoons of gold ribband, but we cannot say we like the design of these last. The drawing room is now under the hands of Mr. Jones, (the author, we believe, of the work on the Alhambra.) The design is in a style somewhat of the time of Henry the Fourth, and is of a most gorgeous character, nearly all gold and silver. The panels represent the story of Mary, Queen of Scots, and the walls are of a bright blue, with fleur-de-lis. The effect is admirable, but there are few, we believe, who will not prefer the light elegance of the banquetting room, which both by night and by day is equally effective.

The Duke of Beaufort has reason to congratulate himself on his determination in every respect; his banquetting room has been executed for a tenth part of the German estimate, will remain for centuries, and would be injured by any but the simplest furniture. As a worthy encouragement of English art and an example to other patrons, Beaufort House and its noble owner have done much valuable service, and we shall be greatly deceived if its results are limited to such a sphere, or confined to the employment of one man. We see, in this mansion, the germ of what can be done in our national and civic edifices, and architects and artists will do but half their duty if they do not agitate until in this line, also, we have distanced foreign rivalry. We have enough artists of fame in the country, we have plenty of latent talent, and it wants but scope for exertion to place us in that position which Englishmen, if they have the opportunity, are sure to attain. For three hundred years we fostered foreign art, and the result was that we did not produce even one good artist for every foreigner employed; we got only Hudson, Oliver, and Thornhill, in exchange for Holbein, Rubens, Vandyke and Lely: we began to depend on our own resources, and we have produced men whose names are known to Europe; in all the branches of art for which we have scope, we have made our way, and in despite of want of instruction, want of taste, and want of encouragement, at any rate we have shown that we can produce high art, if it be but called for. The barbarians who could add whitewashed garrets to the British Museum, are but a portion of the great body of Midases in art, who, by indifference or opposition, check its encouragement by the legislature, and although they have begun to find out that whitewash is not the best back-ground for the Elgin marbles, yet they and their brethren must go a step further, if they wish England to make a good figure in the eyes of its neighbours. There is the British Museum, National Gallery, and Royal Exchange to go to work upon, and above all, the new Houses of Parliament; rich as they are in historical associations, they lose half their value without even a mark to tell the scene of so many great events, where the sovereigns of a mighty empire have been created and deposed, tried and executed, where viceroys and ministers have been arraigned, the destiny of the old world and the new determined, kings made tributary, and slaves set free.

We must by this time have made known the high sense which we entertain of the talents and exertions of Mr. Latilla, and we are disposed to look less at his past works, than to dwell upon the hope of those which are to come. Even since his labours at Beaufort House, he has in Italy acquired fresh power and confidence in his art, and his course of instruction has been such as well to fit him for a higher task. For many years he has devoted himself to fresco painting, and the history of his initiation, which we have heard, is a good lesson of the value that may attach to what we too often despise as trifles. John Nash, the architect, brought home from Italy a collection of designs from the Loggie of the Vatican and some Italian artists, whom he employed to paint part of his house in the Raffaelesque style, and Latilla, then a boy, was employed in finishing it after they left, when he was so struck by what he saw, that from that day he devoted himself to fresco, and exerted himself for its introduction.

PUBLIC BUILDINGS IN LONDON.

A Critical Review of the Public Buildings, Statues and Ornaments in and about London and Westminster—1734.

By Ralph.

(Continued from page 201.*)*

The grand cathedral of St. Paul's is undoubtedly one of the most magnificent modern buildings in Europe; all the parts of which it is composed are superlatively beautiful and noble; the north and south fronts in particular are very perfect pieces of architecture, neither ought the east to go without due applause. The two spires at the west end are in a finished taste, and the portico with the ascent, and the dome that rises in the centre of the whole, afford a very august and surprizing prospect; but still, with all these beauties, it has certainly yet more defects; and the pleasure we receive from the first is so much qualified and tamed by the last, that we rather wonder how we can be pleased so much, than why we are displeased at all. But not to condemn in the gross, I will take the liberty to touch upon a few particulars, and lay myself justly open to censure, in case I mistake, or blame in the wrong place.

In the first place therefore, there is a most notorious deficiency in point of view; such a huge fabric as St. Paul's ought at least to be surveyed at the distance of Temple-bar, and the vista ought to be considerably wider than the front of the building. But this is so far from the case here, that we cannot see it till we are upon it, and this defect is still made worse by turning the edifice from the eye even where it can be viewed, for the sake of that ridiculous superstition of erecting it due east and west. In the next place, the dividing the portico, and indeed the whole structure into two stories on the outside, certainly indicates a like division within: a circumstance abounding with absurdities, and defeating even the very end of erecting it at all. If indeed the architect had been embarrassed to reconcile the distance and height of his columns, I am humbly of opinion that a light and proper attic story had answered all ends both of use and beauty, and left him room to have enlarged his imagination, and have given an air of majesty to the whole: let me add that I apprehend the portico should have been farther projected on the eye, instead of retreating from it, in order to have given a grand contrast to the whole front, and aided the perspective within.

I shall say no more on the outside than this, that according to my best notions of regularity and order, the dome should have been raised exactly in the centre of the whole, and that there should have been two corresponding steeples at the east as well as the west end, with all other suitable decorations; if a view of the whole length of the building, too, could have been opened to the water-side, it would have added greatly to its grandeur and magnificence, and have afforded a most noble prospect from off the river into the bargain. However odd or new the first of these propositions may seem, let any body take a view of St. Paul's from any of the neighbouring hills, and they will instantly discern that the building is defective, and that the form of a cross is more favourable to superstition than beauty; in a word, they will easily see at least, that the dome, in its present circumstance, is abundantly too big for the rest of the pile, and that the west end has no rational pretence to finer and more splendid decorations than the east.

Before we begin our examination of the inside of St. Paul's, it will not be amiss to cast an eye on the statue in the area before it, erected in honour of the late queen. It stands exactly in the front of the building, though it seems, by the odd situation of Ludgate Street, to be on one side, and is, upon the whole, modelled in a tolerable taste, and executed as well; the principal figure, indeed, the queen herself, is an exception to this character; such a formal Gothic habit, and stiff, affected attitude, are neither to be endured or pardoned, and there is not one of those round the base that does not justly deserve the preference.

Whoever understands the nature of public ornamental buildings critically, always lays it down for a rule, that they cannot be too expensive or magnificent; for which reason St. Paul's is so far from being admired for being so grand and august as it is, that nothing is more common than to hear it censured for not being more so. Every body knows that the fund which raised it from its ruins to its present glory, was equal to any design of beauty or majesty; and as those who had it in trust went so far towards this necessary end, it is a thousand pities they did not carry it on much farther, and make this pile not only the ornament of Britain, but the admiration and envy of all Europe. St. Peter's at Rome was already built; a model which the most finished architect need not have been ashamed to imitate, and as all its particular beauties have been long publicly known and admired, I think it was incumbent on us to have equalled it at least; and if we had excelled it too, it would have been no more than might have been reasonably expected from such a nation as ours, and such a genius as Wren.

On these principles it is that men of taste and understanding are surprized, at entering this church, to see so many faults, and miss so many beauties; they discover at once that it wants elevation to give it a proportionable grandeur, and length to assist the perspective; that the columns are heavy and clumsy to a prodigious degree, and rather incumber the prospect than enrich it with symmetry and beauty; half the necessary breaks of light and shadow are hereby wanting, and half the perspective in general cut off; at the same time I do not deny but many parts of the decoration are exceedingly grand and noble, and demand very justly a sincere applause. The dome is, without question, a very stupendous fabric, and strikes the eye with an astonishing pleasure; it is, indeed, one of those happy kinds of building that please all kinds of people alike, from the most ignorant clown up to the most accomplished gentleman; but yet even here the judge cannot help taking notice that it bears no proportion to the rest of the building, and that after you have seen this, you can look at no other part of it; whereas a judicious builder would husband his imagination, and still have something in reserve to delight the mind, though nothing perhaps could be contrived to surprize after it.

For example, the very nature of a choir would not admit of any thing so marvellous as the dome, yet it might have relieved the eye with something equivalently beautiful; the entrance in front might have been more noble and uniform, either composed of wood entirely or marble, for the present mixture of both makes a disagreeable piece of patch-work, that rather disgusts than entertains; the opening on the inside, through the present beautiful range of stalls, might have terminated in a much more magnificent alcove than we see there at present, adorned with all the elegance and profusion of decoration; the altar should have been raised of the richest marble in the most expensive taste, that it might have been of a piece with the rest of the church, and terminated the view of the whole, with all the graces of the most luxuriant imagination. All the intermediate spaces should have been filled up with the noblest historical paintings; all the majesty of frieze-work, cornices, and carving, heightened with the most costly gildings, should have been lavished to adorn it, and one grand flow of magnificent curtain, depended from the windows, to finish and adorn the same.

Thus have I been free enough to give my impartial opinion of St. Paul's; I hope not too presumptuously, and if ignorantly, let every reader's private judgment set me right.

St. Andrew's Holborn, has the advantage of a very good situation, but then it deserves it as little as any modern church in the whole city. The tower is even below criticism, but the inside of the building makes amends for the awkwardness of the out; and is really as neat and well-finished as the manner and taste it is formed in will allow.

Temple Bar is, indeed, the handsomest gate about town, and deserves some degree of applause; if it has any fault, it is this, that the top being round as well as the arch underneath, the whole wants that contrast of figure which is so essential to beauty and taste. The statues on the outside are good, their only disadvantage is the hurry of the place where they are to be viewed, which makes it dangerous to be curious, and prevents the attention to them which they would otherwise command.

The structure of the Temple Gate is in the style of Inigo Jones, and very far from inelegant. I wish I could say the same of the different detachments of building which belong to it, but that is far from being in my power, nor ever can or will; the property is so divided and subdivided, that it is next to impossible that any agreement should ever be made in favour of harmony and decoration. It is certain that nothing can be finer situated than the Temple, along the side of the river, and if we consider the elevation of the ground, and how far it extends, the most barren invention cannot fail of conceiving the uses it might be put to, and the beauties it would admit of. At present there is but one thing which is worth observing in the Temple, and that is the old church which belonged to the Knights Templars of Jerusalem; and the outside even of this is covered from the view, that the whole might be of a piece. The inside indeed is yet visible, and may justly be esteemed one of the best remains of Gothic architecture in this city. The form of it is very singular; you enter first into a large circular tower, which at top terminates in something like a dome, and has a very good effect on the eye; beyond, opposite to the entrance, the church extends itself in three aisles, and is built and finished with as much elegancy and proportion as the taste of those days would allow.

From the Temple it is but a natural step to Lincoln's Inn; but, by the way, it is worth a stranger's curiosity to visit the habitation of the Master of the Rolls, which is certainly built with elegancy and convenience, and can be blamed in nothing but its situation, which is undoubtedly as bad as the building itself is good.

Lincoln's Inn may reasonably boast of one of the neatest squares in town; and though it is imperfect on one side, yet that very defect produces a beauty, by giving a prospect to the gardens, which fill the space to abundantly more advantage. I may safely add, that no area any where is kept in better order, either for cleanliness and beauty by day, or illuminations and decorum by night; the fountain in the middle is a very pretty decoration, and if it was still kept playing, as it was some years ago, it would preserve its name with more propriety, and give greater pleasure into the bargain.

The outside of the chapel belonging to this society, is a very good piece of Gothic architecture, and the painting on the windows has a great many admirers within; in my opinion, indeed, it does not deserve quite so much applause as it has received, because the designs are poor, the faces have little expression, and there is little reason, beside a blind regard to antiquity, to extol them at all. The raising this chapel on pillars affords a pleasing, melancholy walk underneath, and by night particularly, when, illuminated by the lamps, it has an effect that may be felt, but not described.

The gardens are far from being admirable, but then they are convenient; and considering their situation, cannot be esteemed too much. There is something hospitable, too, in laying them open to public use; and while we share in their pleasures, we have no title to arraign their taste.

As I find my business increase upon my hands, as I come nearer the polite end of the town, I shall be obliged to divide it into three distinct walks, that it may appear in something like method, and be a better guide to the stranger, or man of taste and curiosity; in the first I propose to go from Lincoln's Inn Fields to the end of Piccadilly; in the second from Temple Bar to Westminster; and in the last from Gray's Inn to Grosvenor Square.

(To be continued.)

CATHOLIC CHAPELS—MR. PUGIN.

Sir—Your correspondent P. S. (as well as some other contributors to your Journal), evinces what appears to me to be a very needless jealousy of the name of "Pugin," and appears to wish to throw discredit upon the statement of the "Argus," that no fewer than seventeen Catholic Chapels are being erected under that architect. Mr. Pugin has certainly done much to excite the jealousy and spleen of Protestant architects, by the severe rubbing up which he has given us; but would it not be better for us to endeavour to learn wisdom from our enemy, (if he is such), than to content ourselves by showing our spleen at every mention of his name? Would it not be more prudent and more creditable for us to eradicate the errors of taste which he has so mercilessly exposed, rather than to bolster ourselves up with the idea that his lampoons are undeserved, or that he is himself equally open to attack? There can be no reasonable doubt of the fallacy of Mr. Pugin's theory that every architectural vice took its rise among the Protestants, and that every merit belongs to the Romanists; there can be no question that though the "Gothic" styles were invented and brought to perfection among the Catholics, they were also first *relinquished* by the Catholics, and (in modern times) first revived by the Protestants. There can be no doubt that Mr. Pugin himself imbibed his taste for these styles while a Protestant, and that he has since been the first to impart this taste to the Catholics, who had previously (in our times) evinced little or no taste for the works of their forefathers—so that this theory of Mr. Pugin's evidently falls to the ground. This, however, so far from vindicating Protestant architects from the charge of bad taste, removes the excuse which even Mr. Pugin made for them. Mr. Pugin's equally severe, and more just criticisms on the modern Catholic Chapels, have been so well received, that we immediately find chapels starting up in every part of the kingdom, in the purest taste, and many of them on a scale of magnificence which would not have disgraced the best ages of Christian architecture. It now remains for Protestant architects to display their zeal and their talents in a similar manner, and to give practical proof that they have been unjustly handled, rather than to attempt a petty revenge by detracting from the merits of a rival, who with all his eccentricities, is beyond comparison the first Ecclesiastical Architect of the day.

I am, Sir, your most obedient servant,
A Protestant Architect.

London, June 10, 1840.

P.S.—Among the Catholic "Churches" or Chapels I have seen or heard of as being erected, or about to be erected by Mr. Pugin, are those at Derby, Birmingham, Manchester, Keighley, Whitby, Dudley, Reading, at or near Worksop, St. George's Fields, &c., as I have only accidentally seen or heard of these, and have forgotten many more I have heard of, I have no doubt that the number exceeds that named in the "Argus."

ON THE HORIZONTAL AND PERPENDICULAR LINE IN ARCHITECTURE.

By Frederick East, M.A.

(Concluded from page 187.*)*

I had intended with submission to any opinions current amongst professional disquisitors upon the subject of horizontal and perpendicular lines, to have included in the pourtrayal of that matter, a few remarks upon the subject of broken entablatures, so often noticed in a critical way, by the jealous guardian of consistency in classical architecture. Avoiding, however, any further intrusion into the columns of last month's Journal, than the subject *actually* required, I reserved that privilege for the next, and in offering a few opinions upon so interesting a theme, do so with the idea that as this breaking of the cornice is one of the peculiarities of the Palladian school—and of perpendicular Italian; there is a natural link between it and the subject of my last paper, namely, lines.

Some conceive the fashion for breaks, an Italian prejudice discordant with the harmony of correct art, and generally condemn their use as unwarrantable and unmeaning. Others again, in the warmth of their attachment for certain masters, would follow them into every caprice of taste, and find their very eccentricities engaging. I humbly conceive nevertheless, that we cannot employ these breaks, frequently, nor perhaps at all, if the imagination is to be *vigorously* affected,—or if the building, whether in plan or elevation, consists of many parts; since greatness of manner would disappear at once from the superficies, and the eye would compass something of what is little and mean.

Inigo Jones must not lose cast however because he introduces these breaks, and frequently. Popular taste at his time, coveted every thing that was Italian. The king, the court, and nobility, had already conceived these notions, which led them afterwards to vie with each other in the treasures of Italian decoration.

Inigo Jones in the Banquetting House, Whitehall, betrays something more than the ordinary sentiment of his school, by an introduction of these breaks in the façade. That licence so congenial to artist's feelings, seems there betrayed without violence to symmetry; and the effect generally entailed upon their adoption, seems lost in the happiness of his idea.

In the first place the front without them is sparing of details and of breaks. In the second place the building itself was one dedicated to mirth and pleasure: and ideas of strict utility or true support are waved, when the imagination is supposed to be affected by something of the sprightly joys and jovial spirit reigning within. The exterior reveals the interior; you care not as you gaze with your thoughts undisciplined upon the edifice of pleasure, whether you see the column relieving a depending weight, or supporting the various breaks of the entablature. The artist sought to please, and not to affect—to cheer, and not to impose.

With reference to the Persian-court, in the design for the Whitehall Palace. There is a freedom, an ease, nay an almost negligent air, in the breaks and the figures that support them—and the object in view here, I conceive was, to please the eye of the king and his favourites. As if stiffness and solemnity were unwelcome to that monarch and his court:—as if the severities of rule, and the sternness of power, were to vanish at once in a building sacred to ease and kingly relaxation.

However much we may dislike their introduction as a custom in architecture—however much we may blame them viewed in the perspective of a street, and confusing to the eye in half profile, there seems something of agreeable pleasure in their aspect when displayed internally.

In his own dwelling, free from the struggles of life and the world, the statesman is half enchanted into playfulness, by the careless assemblage.—The accurate line, the finish of care the student displays, tending to renew thoughts of care and disquietude—vanish in the varied forms of the columns, which ministers to his ease, sooth and tranquilize, the brow of concern.

There is indeed a strange beauty in architecture. Like the composition of the poet and the painter, the design of the architect is at once a tale of interest—a delusive fiction or a startling truth—and the architect most insidiously works upon the gazer, who most studies the secrets of mental impression.

ON SUB-MARINE FOUNDATIONS.

Sir—There is in your last Journal a description of a light house lately erected under the auspices of Commander Denham, R.N., on a sand bank at the entrance of the Wyre Navigation. This structure has been supported upon and secured to the bank with Mitchell's patent screw moorings. The introduction of this principle to the mooring of vessels is good in the opinion of those who have tried them. They are durable, very compact, and take a firm hold of the ground by means of the flanges, which make them exceedingly applicable for that purpose; in rivers and in harbours they can be screwed down without much difficulty, through mud, sand, or shingle to a certain depth. They are, however, an expensive article, if we take into account the providing of barges and the labour of screwing them down, together with the patentee's charge for the mooring itself.

It would therefore have conferred a favour upon the profession if along with the description of the lighthouse we had been also informed of the cost of its erection. I am quite sure that it might have been done at far less expense on the old principle of driving piles into the ground.

The mooring screws are stated in the drawing to be 10 feet below low water mark, which I suppose may allow them to be 8 feet into the sand. Now the expense of a 3 feet mooring with the patentee's charge and the labour in fixing it to this depth would be about £50. On the other hand the cost of driving a pile, say 12 feet into the ground, with the additional length of timber, would not cost one-tenth of the sum, and piles can be driven into as firm a foundation as the screws. Where then is the great advantage of the screw mooring so applied but to increase the expense.

Again, in my opinion the framing ought to have been quite naked from half tide upwards, to prevent as much as possible the shock of heavy seas from injuring the structure, therefore, much dislike "the systematic interlacing of tension rods to render the fabric sufficiently opaque below the platform." I am also much mistaken if this system of bracing will not cause the tide to scour away the sand from the feet of the framing, and expose the screws to its action.

No practical engineer would in my opinion have adopted such a design.

I am Sir, your obedient servant,
One of the Old School.

TIDES OF THE OCEAN.

Sir—The Newtonian theory of the tides having been questioned by many, in which, I confess, I participate, I should esteem it a great favour, if some of your intelligent correspondents would weed my mind of the doubts that have taken deep root on this subject.

If the moon be the influential cause of the rise and the fall of the tides, why is her influence not universal?

Why does she seem to exercise her influence so powerfully on one sea, less in another, and not at all in others, and why is her supposed power entirely subdued by the effects of particular winds on certain coasts?

Why does the tide, ebb and flood, commence at each turn of the tide to run at the bottom of the sea before the water moves on its surface?

What is the cause that, at an island in the South Pacific Ocean, the time of high water is always the same?

I am aware that the moon and the tides retrograde coextensively, but this does not prove a coincidence.

I am aware, too, that it is said, by way of establishing a theory, that the Baltic and Mediterranean seas are not of sufficient expance to admit of the moon's influence—although the seas are much more extensive than the English or Irish channels—but the real cause why there is no ebb and flow tides in those seas is, that the seas do not rise or fall at either of the points connecting them with the ocean; for the flow and fall of the tides, and the velocity with which the current passes out and in of a tidal harbour or arm of the sea, is governed by the velocity and rise of the tides at the entrances thereto, and therefore, without looking for any other cause, here is the real *cause*.

The great difference of flow in the same sea, has, hitherto, not been satisfactorily accounted for.

Thus, for example, the flow on the eastern shores of America opposite the Straits of Gibraltar, is 30 to 40 feet—*none* on the latter.

A flow on the Pentland Ferbs and along the north coast of Scotland, of 20 or 30 feet; on the coast of Norway opposite, and at the Cattegat, the entrance to the Baltic, no rise in the water.

In the Irish Channel, on the coasts of England and Wales, the flow of the tide is great; on the Irish coast opposite, a small rise of the tides.

In the English Channel, on the French coast the flow is great; on the English coast but comparatively small.

If an allowance is made for the particular formation of parts of the coast, and other local circumstances, they are not sufficient to establish the accuracy of the Newtonian hypothesis on the tides.

I remain, your's, &c.,
14th June, 1840. Nauticus.

WATER OF THE VISTULA.

Sir—In your Journal of last month there appears an account of the casualty in Prussia,—the water of the Vistula having been diverted from its former course, and forced for itself a passage into the Baltic Sea in a new direction, at some distance from its former disemboguing point, *i. e.* via the Old Fairwater. As the current had previously, from times immemorial, passed into the ocean at the latter point, with great sluicing and scouring velocity, produced an impassable bar, so will the water, which now runs out at the new point, produce the like effects, by forming a bar at its new disemboguing point.

The bar at the Old Fairwater having some years back blocked up its entrance, and prevented ships entering to go up to Dantzig to discharge and load their cargoes. A new lateral cut was made, and so formed a passage to sea via the New Fairwater; and at the connecting part of the New Cut with the Vistula, a gate was fixed to prevent the current passage running to sea through the New Fairwater, and although this work has been completed for many years, no bank or bar has been formed at the new entrance, so that the egress or sluicing water constantly in its egress action, has blocked up the old entrance, but as there is no water or current passing to sea by the new Fairwater, no bar accumulates.

The division of the current, before alluded to, cannot in any way affect the entrance to Dantzig by the New Fairwater, but if the current of the Vistula should continue its new course, and not again return to its old channel, a material alteration will soon be discovered in the bar or bank at the entrance of the Old Fairwater.

Nauticus.

ON OBLIQUE ARCHES.

(In Reply to Mr. Buck, C.E., &c. &c.)

Sir—In consequence of what has already appeared in your Journal, I trust to your candour to insert my answer. I consider, Sir, that the insertion of it is not only due to me, individually, but to all who are interested in practical attainments. The facts which I state in reply are plain, and whilst they expose undue pretension, they have the merit of being in themselves irrefutable.

I am, Sir, very truly your's,
Peter Nicholson.

My attention was accidentally called, about the first instant, to an article in the *Railway Magazine*, of the 25th of January, 1840, written by Mr. G. W. Buck, of Ardwich, Manchester, in reply to some remarks which appear in my Treatise on the Oblique Arch, respecting some inconsistencies in certain formulæ, &c., in his "Essay" on the same subject. Mr. Buck says in his reply,—"At page 8 of his preface, in speaking of the forms of his templets which are necessary for working the stones, Mr. Nicholson says—'they are not shown by any other author who has wrote upon the subject.' Now, if Mr. Nicholson will refer to the 3rd chapter of my "Essay," he will find that chapter to be exclusively devoted to an explanation of the method of making the templets and working the voussoirs; moreover the fifth plate contains eight diagrams exhibiting the forms of these templets." Now, Sir, I *have* examined the third chapter of Mr. Buck's "Essay," and I can find *no* method explaining the making of the curved edges of the templets, Nos. 1 and 2, plate 26, in my work, to which I refer when I say "they are not shown by any other author who has written upon the subject;" and I have also examined the fifth plate in his "Essay," which, Mr. Buck says, contains eight diagrams exhibiting the forms of these templets, and I have been equally disappointed, for I can find *no such templets exhibited.* Mr. Buck does not even show how the radius of curvature of these templets may be found; neither does he give a hint that they are necessary. The arch squares, Nos. 3 and 4, entirely depend upon the curved edges of No. 2, and No. 1. Now, Sir, that Mr. Buck should have made these assertions is, to me, a matter of the utmost surprise, seeing that he must have known, when he made them, that he was deliberately stating that which was incorrect. The only method which Mr. Buck gives for working the arch stones is a very complicated and a very clumsy one, the principle of which he has taken from the 55th page of my work on Stone Cutting, published 12 years ago, and which method is much more difficult, even for a person possessed of considerable mathematical knowledge, to work by, and at the same time much more liable to error, than the method which I give, and which, in order to guard against error, I have adapted to the understanding of the most ordinary mason. In fact, it requires very little more attention than a common square segmental or semicircular arch, and the rules, or squares by which the stones are wrought are exceedingly simple in their construction. On this point it may not be amiss to add that although every mason is naturally inclined to work the bed of a stone first, yet, the first conception which I had of forming the stones of an oblique arch was certainly the most rational: first to form the soffit, then one of the beds, and lastly the other bed. And I did this because it was easier to conceive how the spiral surface might be obtained from the cylindric, than the cylindric surface from the spiral surface. This method of working the arch stones was, I believe, adopted from the year 1828, when my book on Stone Cutting was published, and continued until the year 1836, when Mr. Fox published a small Tract, as an original work on Oblique Arches, supposing himself to be the inventor of all that was known upon that subject. He says:—"But I am not aware that any rule has been published that would enable the stones to be wrought at the quarry into the desired form." The templets which Mr. Fox uses are shown in my Treatise on Masonry and Stone Cutting, plate 17, where the two equal circular-edged rules, Z, Z, the straight edge Y, and the arch square γ are those which he employs. Mr. Fox, after some trials in working arch stones, preferred to form the bed to the spiral surface of each arch stone first; and he was certainly the first to apply the winding straight edges for working the spiral surface of the beds, and to show the angle of the twist.

Mr. Buck next goes on to reply to the inconsistency which I noticed in certain formulæ, in his "Essay," and in one part of his Letter he says:—"Here I take the opportunity of saying that, after making the discovery of the mutual convergence of the chords of the curves of the joints of the face of the arch, and after obtaining the formulæ applicable thereto, I long sought in vain for a *demonstration* of the generality of this property. On applying to my mathematical friends, both in London and in Cambridge, I was equally unsuccessful. Under these circumstances, being experimentally quite certain of the existence of this property, I assume it as a postulate in the "Essay," and the whole of the investigation contained in the 7th, a concluding chapter *(the only part of the work which I consider theoretical)* is based upon it. The publisher, Mr. Weale, well knows how anxious I was to have given a demonstration in the work, and that I was finally under the necessity of publishing it without, although no one appears to have noticed this deficiency." This, Sir, I consider to be a sufficient admission of the justness of my remarks, and one which renders it perfectly unnecessary for me to allude further to those remarks at this time. Mr. Buck also says: "It is not my wish or intention to be drawn into a review of Mr. Nicholson's book, but I think it right to make the following few remarks. In problem 9, referring to plates 28 and 29, he gives directions for radiating the joints of the face of the arch in two different ways. By his first method the joints are to be at right angles to a tangent to the elliptic curve; by the second method they will radiate to the point of convergence, which I have denominated the focus; this latter method is that given by me, and which Mr. Nicholson has here adopted. Now, if the voussoirs be worked in spiral beds, *according to his rules*, they must necessarily radiate in this way; and consequently they cannot be made to radiate as described in his first method, *unless the beds are worked in some other way, the directions for which he has not given.* This dilemma leads me to infer that Mr. Nicholson is not practically familiar with the subject on which he has written. I have confined myself to the points referred to by Mr. Nicholson's strictures, or I might have added more on the subject."

Now, Sir, I will reply to these "remarks" in their order, premising that I never have objected to any one reviewing my works *provided that they are competent to the task*, and provided also that they come to the performance of that task in a fair and manly spirit! Now, Sir, first, as to the radiation of the joints. The lines $b\,h$, $c\,i$, $d\,j$, &c., (plate 28 in my book) are not the joints, neither are they intended to be representations of the joint lines; they are merely to direct the construction of fig. 2, in the same plate, in order to find the angles made by lines approximating nearly to the joint lines of the face of the arch, and tangents to the bed lines, or the angles made by these approximating lines to the joints on the face of the arch and tangents to the bed lines at the points in which they meet the plane of the face of the arch; and, in speaking of these lines in my work, at page 16, I say that the method is a near approximation, and that its simplicity is ample compensation for its introduction. Plate 29 of my "Guide to Railway Masonry," was engraved at the same time as plate 20, and is the same in every respect, as regards the construction of the two developements. Plate 20, and its explanation in page 6, was published in Part 2, May 11, 1839, and is referred to at page 27, as being necessary in the construction of plate 29. From the difficulty of getting the proofs from the printer, the third part was divided into two half parts; the first of which was published in August, and the second in November, at Newcastle-upon-Tyne, Mr. Buck's work being published in July, and the 29th plate in my "Guide," showing the method of drawing the joints, and which Mr. Buck says I have "adopted" from his work, being published in August, there was not time for me to have "adopted" his plan, even if I had been driven to such a strait as to think of, or to stoop to, such a thing; and, moreover, I can prove by my engraver *that all the plates in my book were finished* four months *before the letter-press could be got from the printer, and a very considerable period before the publication of Mr. Buck's "Essay."* The joints in the elevation of the arch, plate 29, are drawn by an entirely different method from that used by Mr. Buck, although it may, perhaps, amount to the same thing, and are found by making the developements of the intrados and extrados of the arch, and transferring the points made in each developement by the joints to its corresponding curve in the elevation. These points being joined form the chords of the curves which form the joints in the elevation. We all know, Sir, that "facts are stubborn things," and I leave Mr. Buck to reconcile these facts with his somewhat fugacious assumption that I have "adopted" *his* plan in *my* book.

I now proceed to the second part in which Mr. Buck says—"this dilemma leads me to infer that Mr. Nicholson is not practically familiar with the subject upon which he has written," &c., and upon this point I will refer Mr. Buck to the 10th page of the History of Oblique Arches, in my work, which will, I think, convince him, if he be capable of conviction, that I was perfectly aware, when I wrote my work, of the nature of the joints in the elevation of an oblique arch; in addition to this, I may say that I have seen *nine* oblique bridges on "the Newcastle and North Shields Railway," and *five* on "the Brandling Junction Railway," all executed in stone, on the principle laid down by me, making, upon the two Railways *fourteen* bridges within a distance of about *eight* miles from Newcastle, and built, as it were, under my own immediate inspection. To this I may add, that one oblique bridge was built on "the Hartlepool Railway" in 1834, precisely on my principle, and that I have had the satisfaction of seeing all the stones which were formed by my templets unite closely without requiring the slightest alteration. By this bridge on "the Hartlepool Railway," I clearly show that a bridge was executed from the principles laid down in my Treatise on Masonry and Stone Cutting BEFORE ANY OTHER WORK WAS PUBLISHED ON THE SUBJECT, and that the templets shown in my "Guide to Railway Masonry," plate 26, No. 1, No. 2, No. 3, and No. 4, are decidedly my own discovery or invention. The finding of the angle of the twist is due to Mr. Fox, and I have already said the discovery of the point of convergence in which the chords of the curve of the joints of the arch stones in the face of the arch meet each other is due to Mr. Buck; but I here tell him that although the finding of this point is very useful in drawing an elevation, it is not absolutely necessary in the construction of the oblique arch; and I again maintain that, from the want of proper definitions of the terms used by him, he has written very obscurely of the principles on which he professes to treat, even in describing the common-place things contained in chapter 3. As a farther proof of the correctness of my principles, I insert the following letter which was spontaneously addressed to me by Mr. Welch, C.E., and Bridge Surveyor for the County of Northumberland:—

"Elswick Villas, Newcastle, April 18, 1840.

"To PETER NICHOLSON, ESQ.

"Sir,—Having now seen my design of the Oblique Bridge over the River Tees, on the line of the Great North of England Railway, successfully carried into effect, I am enabled to speak with certainty upon the correctness of your published principles for the construction of Oblique Arches. My bridge consists of four arches, built at an angle of 50°, the chord of the right section of each arch is 45·96 feet, and that of the oblique section is 60 feet. I may also state that I consider your work on the oblique arch the most practically useful of any that I have seen; and as the structure which is near to Croft fully warrants the highest opinion of it, I beg, as a member of the profession, for which you have done much, to thank you for the great pains you have taken in working out so clearly the principle of the Oblique Arch.

"I am, Sir, your most obedient servant,

"HENRY WELCH, Civil Engineer."

I think, Sir, I may safely place this testimony of a *practical man*, against Mr. Buck's assertion that I was not familiar with the subject upon which I had written!

I will now notice one very distinguishing feature between Mr. Buck's work and mine, although based upon the same principles:—Mr. Buck's work is only intended for the use of those who may happen to have been trained in a proper course of mathematical study, and which, I believe, is not the case with a tithe of the young men for whose use, chiefly, Mr. B. has written his book. On the other hand, mine is intended as a purely practical work, and as such, I have shown in it, how every useful length, distance, or angle of an oblique arch may be found, principally by common arithmetic, from the doctrine of similar triangles.

Since the above was written, I have seen an article signed "W. H. B." in the "Civil Engineer and Architect's Journal" for May, 1840, purporting to be "a few remarks on the construction of oblique arches, and some recent works on that subject, but which is, in fact, a mere echo of Mr. Buck's letter, and an ill-natured review of my book, written by some tyro, who understands lamentably little of the subject upon which he professes to write. W. H. B. says, in speaking of my book, "there is a problem 'to find the curved bevels for cutting the quoin heads of an oblique arch,' the reader being unable to learn, from the heading of the problem, whether it relates to square or spiral joints, naturally proceeds to wade through it, with the hope that it may afford some means of ascertaining this fact, but here he soon becomes lost in a labyrinth." Now, sir, I assert that W. H. B must either have been very inattentive, or very stupid, not to have observed to what species of joints the problem referred, since every page in which I treat of the oblique arch has the words "*On the Oblique Arch with Spiral Joints*," placed in capitals over it. W. H. B. next says, "you are told to divide the arc ABC into as many equal parts as the ring-stones are in number, and through the points of division draw *bk*, *ci*, *dj*, &c., perpendicular to the curve ADE." Again, he says, "you are told to join *am*, *bm*, *cm*, &c., but where the point *m* is to be placed Mr. Nicholson has quite forgotten to say." Here I acknowledge an error in point of reference; where I say divide the arc ABC, it should have been divide the arc ADE, which every *impartial* reader would have seen was a mere error in the type, as I immediately mention the arc ADE again, and I have also omitted to say, "draw GM perpendicular to GL." To show W. H. B. how difficult it is to keep clear of errors in printing, I will point out, in the two last sentences which I have quoted from him, no fewer than five blunders—*bk* is an error, there is not a *k* in the page in my book to which he refers; it ought to have been *bh*. Neither is there an *m* in the page, which he has mentioned four times. W. H. B. should at all events transcribe correctly from a work which he professes to criticise so profoundly, or he will assuredly lead both himself and others into "a labyrinth!"

I now state again to Mr. Buck, that neither himself, nor any other writer upon the oblique arch, has shown the templets by which the arch-stones are wrought by my method, and that I am the inventor of all those templets; and I further distinctly tell him, that *had he not pirated his principles from my work on stone cutting, his "Essay," in all probability, would never have been in existence.* I will also tell him that, however fine the theory of the principles of any scientific work may be, those principles will be literally useless, if not *properly adapted to the capacity of the person who has to execute the work!* That I have always considered as the grand object to be attained, and I think I may say, without vanity, after having received testimonials both *publicly and privately*, that I have not been altogether unsuccessful. The draughtsman will find my work on the oblique arch to be as useful and as simple in the delineation of his plans as any work on the subject in existence.

Now, Sir, in conclusion, let me state to Mr. Buck, that this may be the last time that I may have an opportunity of addressing him; for I am now an old man, and, in the ordinary course of nature, may be considered as standing upon the brink of the grave, and am, therefore, unable to undertake the exertion of further controversy with him. What I have done for the working man will be a theme for posterity, when neither Mr. Buck nor myself will have the power of hearing it. I pray that this may not be deemed the boast of an old man—as such it is not intended—but I have thought it my duty to say so much in justice to my own character, with which Mr. Buck has taken such unwarrantable liberties. I could not have rested satisfied without giving vent to my feelings at the ingratitude which Mr. Buck has shown. But, Sir, I have now done with him, and

"PALMAM QUI MERUIT, FERAT!"

PETER NICHOLSON.

Newcastle-on-Tyne, May 23, 1840.

SIR—In my paper on Oblique Bridges in reply to B. H. B., which is published in your Journal for this month, I have inadvertently inserted a few words which are incorrect, and ought to be expunged. At the second line from the bottom of the first column of the 198th page, the following sentence commences:—"this triangle must be supposed to exist in the thickness of the arch, *and to be parallel to a tangent plane at the point sought*, and therefore," &c. The words in italics I ought not to have inserted, and I shall be obliged by your giving notice to this effect in your next number.

Your most obedient servant,

Manchester, June 8, 1840. GEO. W. BUCK.

Antiquarian Discoveries in France.—"A discovery has recently been made at Bougon, near Mothe-Saint-Heray, in the Two Sevres, of a tumulus, which promises to throw great light on the civilization of the ancient Celts. A gallery and vast grotto has been opened. It is formed of nine stones in erect positions, covered by a slab twenty-six feet three inches in length. The interior is completely filled with bones. The head of each skeleton touches the walls of the grotto, and by the sides of each vases of baked earth, containing provisions for the use of the deceased in the other world, the wahala or paradise promised to the brave. Nuts and acorns are found in these vases in perfect preservation. There have also been found two hatchets and two knives made of flint, several smaller sharp instruments, the use of which is not known, two collars, or necklaces, one of shells and the other of baked earth, several bears' tusks, the bones of a dog, and a plate, upon which there are fragments of a rude design. Four of these vases are perfect: two of them very much resemble flower-pots; a third has the form of a soup-tureen; and the fourth, though much the smallest, is the most curious, as it is the cup of a Druid. The tumulus is two hundred paces in circumference, and between eighteen and twenty feet high. Its formation may be placed at 2,000 years ago. The vases and utensils attest the infancy of the arts, and the nascent civilization of a barbarous people."—*Quotidienne.*

Ancient Monuments.—A discovery has been made in a cellar in Paris, at the corner of the Rue Mauconseil, in the Rue Saint-Denis, of nine figures in stone, the size of life, having the heads and garments coloured and gilt. They are the figures of saints and kings, and one of them wears a helmet. They apparently belong to the earliest times of the revival of art; and have, in all probability, been buried where they were found, to escape the ravages of some outbreak of Iconoclasm. It is probable that they belonged to the ancient church of the *Pelerins de Saint-Jacques*, which stood near the site of their discovery.

AN ESSAY ON THE CONSTRUCTION OF OBLIQUE ARCHES.*

By Edward Sang, M.S.A., Civil Engineer, Edinburgh.

(Abridged from the Edinburgh New Philosophical Journal for April.)

Scarcely any branch of civil engineering bears so closely on the advancement of civilization as the art of road-making. The immense sums that are annually expended on them evince the importance of our roads. Our object is not merely to find a path from one town to another, we must be transported in the most expeditious manner possible. Is there a declivity; thousands are spent to remove it: is a road suspected of being a few yards longer than is needed? a new line is immediately chalked out. One might almost imagine that a monomania had seized us, and that the tulip, the dog, the pigeon, and all the other fanciers had deserted their peculiar departments to concentrate their energies on this one grand matter of roads. The madness is a very reasonable one; for if there be a hill, multitudes daily climb and descend it: or if a road be circuitous, the quantity of unnecessary travelling might soon be sufficient to carry one comfortably round the globe.

While journeying, we are often annoyed by bridges. Sometimes, for cheapness, they have been erected far out of the line of road, and we enjoy, on one side of a river, the delightful prospect of doubling along the other. At other times, after skirting the banks as if on a journey to the source, we are all at once wheeled right across the water, and ere we are certain that our necks are yet safe, an equally sudden turn restores us to our original direction. And occasionally our vexation is crowned by an altercation between the drivers as to which of two vehicles is bound to back down the steep slope of some antiquated erection. That time has now gone by when a bridge of any kind was hailed with satisfaction; we have scarcely such a thing as a ford wherewith to contrast it, and having only bridges to compare with bridges, we have become somewhat nice in our taste. Many of the old high-backed bridges have been replaced by others with level road-ways; these again by bridges with road-ways inclined to suit the elevation of the opposite banks, and now another improvement is beginning to be called for, that of crossing the river obliquely, so as to make the bridge harmonize with the general line. This we may consider as the *ne plus ultra* in bridge building, for then the road-way over the bridge coincides both in plan and in section with the rest of the road, and therefore conducts us in the easiest manner possible from the one bank to the other. The skewed arch is inseparable from the railway, as by its introduction alone the engineer is able to free the line from awkward and injurious turnings.

Having been consulted concerning the construction of an oblique bridge of considerable magnitude, and never having met with any regular investigation into the theory of such structures, I was induced to undertake the analysis. The results of that analysis I proceed to lay before the Society of Arts, in the hope that, though I may be wrong in supposing them new, their publication may serve to disseminate correct notions on this intricate subject. It is a common idea that the oblique is weaker than the right arch, and that the twist of the stones causes a great waste of material. The truth is, that if both bridges be skilfully constructed, there is no difference in point of strength between them, while the twist on the arch-stone of the oblique bridge causes a most trifling loss of matter, and therefore our road trustees should never hesitate to adopt that which agrees best with the rest of the line. There is no limit to the obliquity, nor need even the several abutments run parallel with each other.

The general question of the construction of an arch resolves itself into two parts; the first relating to the connexion which ought to exist between the curvature of the vault and the weight piled on each portion of it, is absolutely identical in the two cases of right and oblique bridges, and is therefore left out in the present inquiry; the second, however, relating to the forms of the arch-stones, bears directly on the oblique arch, and will therefore engross almost our whole attention. The outline of the bridge and the form of the vault having been determined on, the problem becomes this: *To cover the surface of the centering with blocks of such sizes and forms as may insure the stability of the structure.* Now, if it be premised that the curved surface of the vault must never be vertical, the solution of the problem can always be attained.

It is clear, from the general form of a bridge, that the lines of pressure ought to run from one abutment to the other, and should be contained in vertical planes parallel to the walls of the parapet. Imagine, then, that the vault is intersected by a multitude of such planes, the lines of intersection will indicate the directions in which the pressures ought to be transmitted from block to block. Now the stability of a structure is obtained by making the surfaces at which the pressures are communicated perpendicular to the directions of those pressures, and therefore all that is required is to trace on the surface of the centering a line which may cross all the lines of pressure at right angles. In the case of the right arch, that line is a parallel to the abutment; but in the oblique arch it becomes bent in a peculiar manner.

At the crown of the cylindrical oblique arch, the joint-line is perpendicular to the parapet; of course, it begins to descend on the surface of the vault, and as it descends it gradually bends away from that direction to become more and more nearly parallel to the abutment. If the crown line be regarded as the absciss, and the line of pressure as the corresponding ordinate of the joint, the differential co-efficient of the line of pressure is in all cases proportional to the cosine of the inclination which its extremity has to the horizon. If there be, then, two closely contiguous joints, the portions of the lines of pressure intercepted between them will be proportional to the cosines of the obliquities, and hence it follows that the breadth (measured on a line of pressure) of the stones in a given course diminish in the ratio just mentioned. It is a well known principle, that the strain upon any arch stone is proportional to the secant of the same obliquity; and thus, if the depth of the stones be augmented to meet this increased strain, it would follow that each voussoir in any given course ought to exhibit the same extent of section by a plane parallel to the parapet. The arch stones, both for convenience of workmanship and for appearance, must be uniformly disposed from side to side; and hence throughout the whole structure they ought to be of uniform volume, with the exception of the half stones left at the end of each alternate course for the purpose of *breaking the joint.* The deepening of the arch-stones toward the spring of the arch is often, though very improperly, omitted ; in such case the above statement does not hold true.

Even although the arch-stones were all equally broad upon the centering, those nearer the abutments would appear narrower on the Ground Plan, the breadths of their projections being proportional to the cosines of their obliquity: hence the ground plan of an oblique arch must present a very rapid diminution of breadths toward the spring of the arch, the breadths of the projections being, indeed, proportional to the squares of the cosines of the obliquities.

The Side Elevation of a vault with uniform voussoirs would exhibit narrower intervals toward the crown, the breadths being proportional to the sines of the obliquities; hence the side elevation of a skewed arch must present narrow intervals both at the crown and at the abutment, and wider intervals upon the shoulders. The breadths are proportional to the products of the sines by the cosines of the obliquities; that is, to the sines of twice the obliquities; and thus the side elevations of those arch-stones which are inclined at 45° will be the broadest.

The End Elevation, or the projection of a joint upon the plane of the parapet, possesses the very singular property of being entirely independent of the angle of the skew, and of depending alone on the form of the longitudinal section of the vault. This curious fact can very readily be demonstrated. The projection of a right angle upon a plane parallel to one of its sides is always a right angle, and therefore the projection of the joint upon the plane of the parapet must cross the projection of every line of pressure upon the same plane perpendicularly. But the projections of all the lines of pressure are equal to, and placed side by side with, each other, and are so whatever may be the angle of the skew, so that the delineation of the end elevation of a joint, which requires only the tracing of a line that may cross all these at right angles, will be performed exactly in the same manner whether the bridge be more or less oblique. When the angle of obliquity diminishes to zero, that is, when the bridge becomes *right,* the end projections of the joints contract into mere points, which points are the commencements, so to speak, of the permanent curves above mentioned.

The end elevations of the *beds* of the voussoirs, or rather of the lines formed by the intersection of these beds with the planes containing the lines of pressure, are also normals to the lines of pressure, and must therefore be tangents to the end projections of the joints. From this it follows, that a short portion of a course, or a single arch-stone, is very nearly contained between two planes slightly inclined to each other; and that, therefore, the loss of material arising from the *twist of the stone* must always be insignificant. Those engineers who have experienced a loss on this account, have done so because their bridges were not properly designed. If the stones be obtained in *squared blocks* from the quarry, there will be a loss on the ends of the stones; but this, as every builder knows, can be avoided by proper management in the quarry. And thus, on the whole, the loss of material for the skewed bridge need not exceed to any extent worth naming that for the right one.

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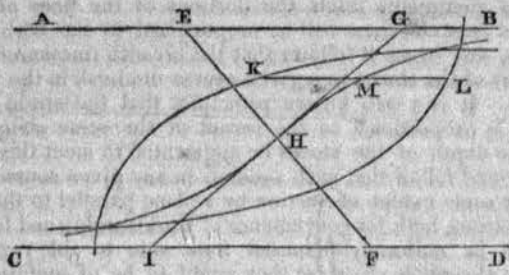
* Read before the Society for the Encouragement of the Useful Arts in Scotland, on 18th November and 2nd December, 1835; 27th January, 1836, and 16th May, 1838.

The above statements are true of cylindroid oblique arches, *whatever may be the forms of their principal sections;* they are at variance with the statements and so-called experience of engineers of established reputation: complete demonstrations of them are given in the appendix. They are equivalent to differential equations, and require to be integrated in order to give practical results; these results vary according to the particular form assumed for the longitudinal section of the vault. I proceed to give a few of these results, commencing, on account of its more frequent occurrence, with the circular arch.

On investigating the form of the projection of a joint of a circular oblique arch upon a horizontal plane, I arrived at a new curve, to which the name *Double Logarithmic* has been given.

Fig. 1.



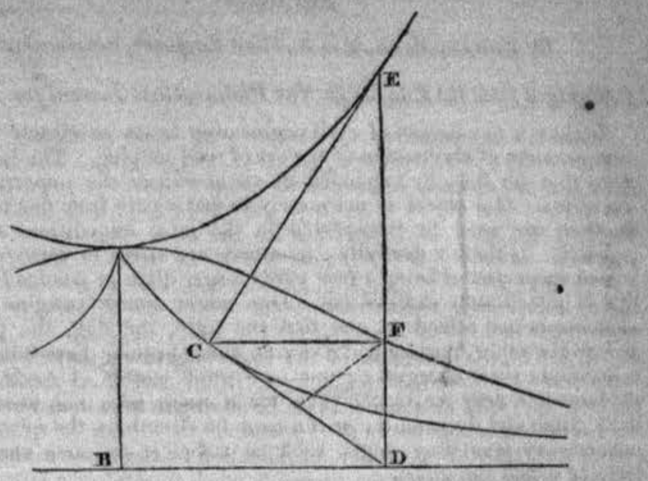
Having projected the entire semicylinder, of which only a portion can be used with propriety, let AB, CD, be the sides of the projection, and EF, parallel to the parapet, the plan of one of the lines of pressure. Bisect EF at right angles by GHI, and form two logarithmic curves of which AB, CD, may be the asymptotes, EG the common subtangent, their ordinates being parallel to EF. Then draw lines KL parallel to AB, and intercepted between the logarithmics, the middles M of these lines trace out the horizontal projection of one of the joints. The lines AB, CD, are thus asymptotes to the horizontal projection, and this geometrical property illustrates the mechanical impossibility of constructing a semicylindric arch, without trusting to the cohesion of the mortar. The introduction of the logarithmic curve into investigations concerning bridges, has been of great utility, and the analogy between this curve and the common catenary is striking. The catenary is also formed by bisecting the interval between two logarithmics; but these have a common asymptote with rectangular co-ordinates, while the bisected line is parallel to the ordinate. The computations needed for the delineation of such projections, are by no means tedious: they may be performed rapidly by help of Napierian logarithms; but a better method, capable of giving all the projections, will be explained shortly.

It may be expected, from what has been said of such elevations in general, that the end elevation of a circular oblique arch shall present some interesting peculiarity. The end elevation of a joint ought, in fact, to cross at right angles the circumferences of circles described with equal radius from points lying in a straight line; now, this is the distinguishing characteristic of the tractory, and that curve must therefore be exhibited on the end projections of all circular oblique arches.

On examining the projection of one of the joints upon a vertical plane perpendicular to the parapets, I obtained the genesis of a peculiar curve still logarithmic in its nature, and somewhat resembling in its form the superior branch of the conchoid. If we conceive the side elevation of the semicylinder to be traversed by horizontal lines, the distances intercepted on these lines bear to the corresponding distances intercepted by a certain normal curve, the ratio of cotangent of obliquity to radius. This normal curve, which belongs to an arch with its obliquity 45°, I have named the COMPANION TO THE TRACTORY; it admits of a very neat mechanical delineation.

Let a rod AB, equal in length to the radius of the arch, be made to rest upon a smooth board only at the point A, while the extremity B is guided along the line BD; A will, as is well known, describe the equitangential curve or tractory. Suppose that the guide to which the point B (or in an oblique position D), is attached, carries a vertical rule DFE, and that, on that rule, there slides a right angle DFC, one side of which is constrained to pass through C:* then will the point F trace the *Companion to the Tractory.* A very simple addition will convert this instrument into that described by Leslie in his Geometry of Curve Lines, for forming the catenary. A grooved rule has only to be attached, making the right angle DCE, while the groove DF is continued to meet it: E then traces out the catenary. Since, *from the nature of the figure,* $ED\ DF = AB^2$, it follows, that the companion to the tractory has its ordinates inversely proportional to those of the catenary, and that, therefore, it might, with propriety, have been named the *inverted catenary.*

Fig. 2.



All these projections of the joints, and the forms too of the individual arch-stones, can be much more readily obtained from the delineation of the surface of the centering. Regarding the crown line as the absciss, and the actual lines of pressure as the ordinates (on the curve surface), half the ordinate plus 45°, has its logarithmic tangent proportional to the absciss. Having once obtained the log-tangent corresponding to a given distance along the crown line, a simple proportion will give that corresponding to any other absciss; the log-tangent corresponding to half the length of an arch-stone having been found, the repeated addition of that quantity to itself will lead to a knowledge of the position of the corner of each stone in the whole structure, the simplest operations of trigonometry only being needed. Indeed, the labour of the whole calculation is but a minute fraction of that expended in the drawing of the plans. By these means, the accompanying model of the surface of the centering, its development, and various orthographic projections, were completed.* The simple inspection of these, and their comparison with most of the skewed bridges already constructed, will shew in what respects this branch of architecture has hitherto been defective.

I cannot leave the subject of the circular arch without indicating the extensive and indispensable use of logarithms in the calculations. Napier, when he founded first the rudiments of the fluxional calculus, and thence the logarithmic method, sanguine though he may have been as to the immense value of his discoveries, could never have imagined the prodigious impulse which they have since given to every branch of exact science. Each new mathematical research piles another stone on the monument of Napier.

Neither can I avoid remarking, that the ingenious speculations of the earlier geometers concerning the various mechanical curves, speculations which have been by many regarded as fanciful and useless, are one by one turning to account in the progress of modern philosophy.

The elliptic arch, being much recommended by the gracefulness of its form, is frequently used. If we view the circular oblique arch from a distant point in the continuation of its axis, it does indeed appear elliptical; but then the ellipse has its major axis directed vertically, so that a circular skewed bridge can hardly have a fine appearance unless the segment be extremely flat. Let us then inquire into the phases of an elliptic skew.

The horizontal plan of the joint is still a double logarithmic curve; and its delineation, including, of course, that for the circular arch, is as follows.

EF being as before, the plan of one of the lines of pressure, find HQ a third proportional to the horizontal and the vertical semi-axis; through Q draw Q'E parallel to HG. Describe then logarithmics having E'G for their common subtangent, and having their ordinates

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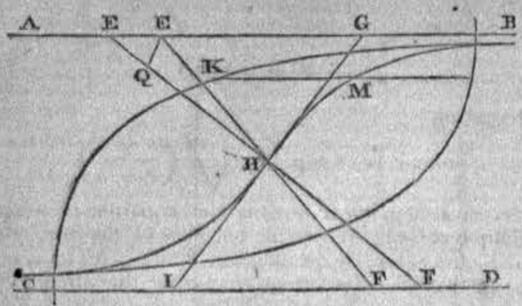
* In practice, it would be more convenient to lay a jointed rod equal to half AB from the middle of AB to the rule DFE as indicated by the dotted lines.

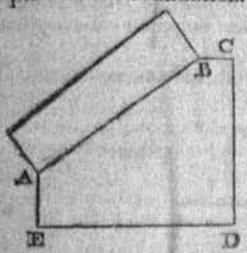
* These are deposited in the Museum of the Society of Arts of Scotland

Fig. 3.



parallel to E'H, the bisection of the interval between these will give the horizontal projection of the joint. Similarly, the side and end projections are modifications of those belonging to the circular arch:—they are fully investigated in the appendix.

Having obtained a tolerable approximation to the forms of the arch stones, it is not uncommon for bridge-builders to throw the remaining responsibility on the abutments, which, besides transmitting the pressure, have to continue its distribution among the parts of the pier. In truth, the principles of equilibrium seem never, even in the case of the right arch, to have penetrated beyond the facing stones of the piers; and the effect of the arrangement *in every bridge which I have seen, or the drawings for which I have inspected*, is to throw the whole weight of the arch on the outside stones of the pier and on the outer row of piles in the foundation. To see this clearly, let us draw one of the abutment stones of a right bridge. The oblique face AB receives the pressure of the lowest voussoir; and it ought to receive that pressure perpendicularly. But the stone is prevented from yielding by resistances against the surfaces CD, DE: the pressure of the voussoir is thus decomposed into two pressures, one against CD, well known to be the horizontal thrust of the bridge, and the other against DE, equal to the weight of all the mason-work between the crown of the arch and the vertical line through B. Now, since all the stones of the piers are squared, no change (except by improper straining) can take place in the directions in which these pressures are propagated. The pressure against CD is communicated along the abutment course to the spring of the next arch, or to the corresponding breadth of the final abutment; while the pressure against CD is transmitted through the facing stones of the pier to the outer row of piles. It will, indeed, be said, that the cohesion of the mortar, and the alternate jointing of the courses, render the pier one mass, and that, therefore, such niceties are not worthy of attention. But, indeed! is the final disposal of the entire strain of a bridge such a trifle? Then let us fit our arch-stones by guess, and sweep the span in any fancy. It is at this very corner that all the care of the engineer is required; and I do maintain, that the method in common use outrages the doctrines of equilibrium, and renders our arches less secure than they ought to be. It is a piece of bad engineering to throw the whole weight of a bridge upon one row of its supports, and to give the others scarcely any strain; especially when it is considered that that row is most liable to decay. The alternate jointing of the stones calls into action that species of resistance which ordinary building-material is least capable of exhibiting; one end of a stone is pressed downwards, while its other end is engaged between two blocks; the consequence is a tendency to break the stone over, to *distend* its upper surface; and it is notorious that the strength of stones in this way is much inferior to their power of resisting a simple crush. The alternate jointing and the mortar are useful enough in correcting the bad effects of unavoidable inaccuracy; there is no need for deliberate error to put them to a severer use.



The best possible arrangement is to give to each square foot of the foundation its fair share of the whole burden. In order to do this, it becomes necessary to lay a counter arch, of a parabolic form (its convexity downwards), upon the pier-head. Such an abutment course would carry the horizontal thrust to the spring of the next arch, precisely as a flat course would; but it would distribute a uniform downward pressure on each horizontal foot; and, in this way, the foundation would be pressed on exactly as if the whole weight of mason-work, from the crown of the one arch to the crown of the other, were piled upon it in squared courses.

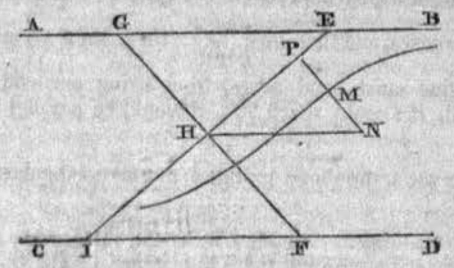
On investigating the forms of the joint on a parabolic skew, I found its plan to be a line of the third order, the double parabola; that its end elevation is a semi-cubic parabola; and that its side elevation is another line of the same order. Students of the higher mathematics will at once recognise the equations of these curves as the results of other inquiries. For the computations of the parts, on account of the regular progression of the different examples, the method explained in my treatise *On the Solution of Equations of All Orders*, will be found to afford peculiar facilities.

Appendix.

In the preceding part of this paper, I have stated the general principles which ought to regulate the construction of oblique arches. In this, the second part, I propose to enter more into detail, and to give the demonstrations of the theorems above laid down.

The general investigation into the stability of a vault would necessarily be complicated by the peculiarities of the ultimate abutments, and by the assumed directions of the lines of pressure; for these directions are, within certain limits, arbitrary. For the present purpose, it is enough to consider the case of a vault resting on parallel abutments, cylindroid, and having the lines of pressure contained in vertical planes parallel to each other.

Fig. 5.



Let AB, CD, represent the two abutments, HN the crown line, GF and PN the horizontal projections of two of the lines of pressure.

Of rectangular co-ordinates, let the x be in the direction HG, the y in PM, and the z vertically. For convenience, also assume oblique co-ordinates v along HN, u along NM, and z as before; put also GHN the angle of the skew $= s$. The formulæ of conversion will be

$$\left.\begin{array}{l} x = v \cos s,\ y = v \sin s - u;\ z = z \\ v = x \sec s,\ u = x \tan s - y,\ z = z \end{array}\right\} \quad . \ . \ \text{A}$$

If the equation of the generating curve of the vault, of which EF is the projection, be taken

$$u - \phi z = 0 = \text{B}$$

the same equation will serve as that of the vault itself; or in rectangular co-ordinates

$$x \tan s - y - \phi z = 0 = \text{B, whence}$$

$$\frac{d\,\text{B}}{d\,x} = \tan s;\ \frac{d\,\text{B}}{d\,y} = -1;\ \frac{d\,\text{B}}{d\,z} = \phi' z.$$

The equation of the plane containing one of the lines of pressure is,

$$x - \text{X} = 0 = c;\ \text{whence}$$

$$\frac{d\,c}{d\,x} = 1, \frac{d\,c}{d\,y} = 0;\ \frac{d\,c}{d\,z} = 0;$$

so that the equations of the straight line touching B =, 0 $c = 0$ are

$$\frac{\text{X} - x}{0} = \frac{\text{Y} - y}{-\phi' z} = \frac{\text{Z} - z}{-1} \quad . \ . \ \text{(D)}$$

where X, Y, Z belong to any point in the tangent; x, y, z to the point of contact.

Again, let $u - \theta v = 0 = \text{E}$ be the equation of the horizontal projection of a joint, or in rectangular co-ordinates,

$$x \tan s - y - \theta (x \sec s) = 0 = \text{E};\ \text{then}$$

$$\frac{d\,\text{E}}{dx} = \tan s - \sec s.\,\theta' v;\ \frac{d\,\text{E}}{dy} = -1;\ \frac{d\,\text{E}}{dz} = 0.$$

The equations of the joint are B = 0, $c = 0$, therefore, those of a line tangent to it are

$$\frac{\text{X} - x}{\phi' z} = \frac{\text{Y} - y}{\phi' z\,(\tan s - \sec s.\,\theta' v)} = \frac{\text{Z} - z}{\sec s.\,\theta' v} \quad . \ . \ \text{(F)}$$

The stability of the structure demands, that the line whose equations are (F) be perpendicular to that whose equations are (D), therefore the condition of stability is contained in this equation,

$$(\phi' z)^2 (\sin s - \theta' v) = \theta' v$$

$$\left.\begin{array}{ll}\text{or} & \phi' z = \sqrt{\left\{\dfrac{\theta' v}{\sin s - \theta' v}\right\}} \\ \text{or} & \theta' v = \sin s \dfrac{(\phi' z)^2}{1+(\phi' z)^2}\end{array}\right\} \quad . \quad . \quad . \quad (G)$$

The last formula may also be put thus:

$$\frac{\delta u}{\delta v} = \sin s \frac{d u^2}{d u^2 + d z^2}$$

in which the characteristic δ refers to the joint, d to the line of pressure. But $\dfrac{d u^2}{d u^2 + d z^2}$ is the square of the cosine of the inclination of the line of pressure to the horizon; whence, if we denote that inclination by i,

$$\frac{\delta u}{\delta v} = \sin s . \cos i^2 \quad . \quad . \quad . \quad (H)$$

When, then, as is the case at the crown of the arch, i is zero $\dfrac{\delta u}{\delta v} = \sin s$; but $\dfrac{\delta u}{\delta v} = -\dfrac{\delta y}{\delta v} + \sin s$ so that, at the crown, $\dfrac{\delta y}{\delta v} = o$, that is, the horizontal projection of the joint, is there perpendicular to the parapet, as might easily have been anticipated; but when i increases, its cosine decreases, and therefore $\dfrac{\delta y}{\delta v} = \sin s . \sin i^2$ (I) must increase: that is, the line must bend away, from being perpendicular to the parapet, until, if i could reach 90°, it would be parallel to the abutment.

Since $\dfrac{\delta v}{\delta x} = \sec s$, the above quotation put in rectangular co-ordinates becomes,

$$\frac{\delta y}{\delta x} = \tan s . \sin i^2 \quad . \quad . \quad . \quad (K)$$

If a be taken to represent the arc of which u is the projection, $\cos i = \dfrac{du}{da}$ and equation H becomes,

$$\frac{\delta a}{\delta v} = \sin s . \cos i \quad . \quad . \quad . \quad (L)$$

and thus, if we imagine two joints running quite close to each other, cutting the crown-line at the minute distance δv, the distance δa, intercepted between them on the arc, or the breadth of the course, is proportional to cosine i.

The above equation can also be put under the form

$$\frac{\delta a}{\delta x} = \tan s . \cos i \quad . \quad . \quad . \quad (M)$$

Again, we have $\dfrac{\delta u}{\delta z} = \cot i$; whence equation H becomes,

$$\frac{\delta z}{\delta v} = \sin s . \sin i . \cos i = \tfrac{1}{2} \sin s . \sin 2 i . \quad . \quad . \quad . \quad (N)$$

$$\frac{\delta z}{\delta x} = \tan s . \sin i . \cos i = \tfrac{1}{2} \tan s . \sin 2 i . \quad . \quad . \quad . \quad (O)$$

From which it will be seen, that the general statement made as to the side elevation of the joint is true.

Lastly, we have

$$\frac{\delta y}{\delta z} = \sin s \frac{\delta v}{\delta z} - \frac{\delta u}{\delta z} = \tan i = \frac{\delta z}{\delta u} \quad . \quad . \quad . \quad (P)$$

whence it is, that the end elevation of the joint crosses that of the line of pressure at right angles.

Before proceeding to apply the above differential equations to particular cases, the following recapitulation may be made:

Equation H gives the Horizontal Projection.
.. L .. Development.
.. O .. Side Elevation.
.. P .. End Elevation of the Joint.

And it is to be remarked, that these equations are absolutely general, applying to every skewed cylindroid arch.

Having now completed the general investigation, I proceed to apply the principles to specific cases; in the first case to the circular arch.

Denoting by r the radius of the circle, we have

$$i = \frac{a}{r}, \; z = r \cos \frac{a}{r}, \; u = r \sin \frac{a}{r}; \; z^2 + u^2 = r^2;$$

equations which take the place of (B) in the general analysis.

For the horizontal projection of a joint we have

$$\frac{\delta u}{\delta v} = \sin s \left(\cos \frac{a}{r}\right)^2 = \sin s \frac{r^2 - u^2}{r^2}$$

and thus

$$\frac{\delta v}{\delta u} = \text{cse } s . \frac{r^3}{r^2 - u^2};$$

whence integrating

$$v = r . \text{cse } s \text{ nep. log} \sqrt{\left(\frac{r+u}{r+u}\right)}$$

Now $v' = r . \text{cse } s . \text{ nep. log } (r + u)$ is the equation of a logarithmic curve to oblique co-ordinates having one side of the semicylinder for its axis, and r cse s. for its subtangent: while $- v'' = r . \text{cse } s . \text{ nep. log } (r - u)$ is that of a similar curve having the other side of the semi-cylinder for its asymptote, and thus the v of the joint which is the arithmetical mean of these is obtained by bisecting the interval between the two logarithmics.

Passing to common logarithms, and putting M for the modulus, ·43429448, &c. we have

$$v = \frac{r . \text{cse } s}{2 \text{ M}} \log \frac{r+u}{r-u}$$

$$u = r \frac{10^{\frac{2 \text{ M } v}{r \text{ cse } s}} - 1}{10^{\frac{2 \text{ M } v}{r \text{ cse } s}} + 1}.$$

The horizontal projection of the joint of a circular skewed arch is thus a new curve, to which I have given the name of Double Logarithmic: the analogy between this curve and the common catenary has already been pointed out.

In order to trace the side elevation, we must resume equation (O) which, when adapted to the circular arch, is

$$\frac{\delta z}{\delta x} = \tan s . \frac{z}{r} \sqrt{\left(\frac{r^2 - z^2}{r^2}\right)} \qquad \text{whence}$$

$$k = \frac{r . \cot s}{z} \text{ nep. log} \frac{r + \sqrt{r^2 - s^2}}{r - \sqrt{r^2 - z^2}}$$

$$= \text{nep log } 10 . r . \cot s \log \tan \left(45^\circ + \frac{a}{z r}\right)$$

But the equation

$$x' = \frac{r}{z} \text{ nep. log} \frac{r + \sqrt{r^2 - z^2}}{r - \sqrt{r^2 - z}} - \sqrt{r^2 - z^2}$$

is just the equation of the tractory, whence

$$x'' = \frac{r}{z} \text{ nep. log} \frac{r + \sqrt{r^2 - z^2}}{r - \sqrt{r^2 - z^2}}$$

is the equation of a curve having its ordinates greater than those of the tractory by the quantity $\sqrt{r^2 - z^2}$, this curve I have named the *companion to the tractory*, or, on account of the connection which is explained in the paper, and which at once flows from the above, the *inverted catenary*.

The equation for the end elevation of a joint adapted to the circular arch is

$$\frac{\delta y}{\delta z} = \sqrt{\left(\frac{r^2 - z^2}{r^2}\right)} \qquad \text{whence}$$

$$-y = \text{nep. log} \sqrt{\left\{\frac{r + \sqrt{r^2 - z^2}}{r - \sqrt{r^2 - z^2}}\right\}} - \sqrt{r^2 - z^2}$$

which is the well known equation of the tractory. This is the characteristic curve of the circular oblique arch: as all tractories are similar to each other, it is easy to make a table of its co-ordinates.

The preceding equations enable us to obtain any one of the projections of the joint, and are essential to a knowledge of the nature of the different curves. They are, however, inconvenient when we wish to ascertain the dimensions of the individual arch-stones, and need, for that purpose, to know the intersection of the joint with any one of the lines of pressure. The equation of the development furnishes us with the means of obtaining these points, as well as all the projections, by processes remarkable for their simplicity. To find this equation I resume (L) which, adapted to the circular arch, becomes

$$\frac{\delta v}{\delta a} = \text{cse } s. \sec \frac{a}{r} \qquad \text{whence}$$

$$v = r. \text{ cse } s. \text{ nep. log tan} \left(\frac{\pi}{4} + \frac{a}{2r}\right)$$

or, observing that $\frac{a}{r} = i$, and passing to common logarithmic tables,

$$v = \text{nep. log } 10.\ r \text{ cse } s. \text{ log tan } \left(45^\circ + \frac{i}{2}\right)$$

whence by inversion

$$\text{log tan } \left(45^\circ + \frac{i}{2}\right) = \frac{\text{M. sin } s}{r}.\ v.$$

from which the values of i can be very easily found; especially when they correspond to equi-different values of v.

The expert computer will now perceive at a glance, that all the operations needed to determine the co-ordinates of the various points may now be arranged in a simple tabular form so as to require scarcely any figuring.

I now proceed to the Elliptic Oblique Arch. Put r for the horizontal and ρ for the vertical radius; the equation of the curve then becomes

$$\frac{u^2}{r^2} + \frac{z^2}{\rho^2} = 1$$

which takes the place of (B).

This equation may also be put under the form

$$u = r \sin \alpha,\ z = \rho \cos \alpha.$$

where α is the inclination of the trammel bar that would trace out the ellipse; from this we find

$$\frac{\delta v}{\delta \alpha} = \frac{\text{cse } s}{r} \left\{ (r^2 - \rho^2) \cos \alpha + \rho^2 \sec \alpha \right\} \qquad \text{whence}$$

$$v = \frac{\text{cse } s}{r} \left\{ (r^2 - \rho^2) \sin \alpha + \rho^2 \text{ nep log tan} \left(45 + \frac{\alpha}{2}\right) \right\}$$

Otherwise we obtain

$$\frac{\delta v}{\delta u} = \frac{\text{cse } s}{r} \left\{ (r^2 - \rho^2) + \rho^2 \frac{r}{r^2 - u^2} \right\}$$

$$v = \text{cse } s \left\{ \frac{r^2 - \rho^2}{r^2} u + \frac{\rho^2}{r} \text{ nep log} \sqrt{\left(\frac{r+u}{r-u}\right)} \right\}$$

At first glance it might be thought that this equation gives a new curve; it is, however, still a double logarithmic, having its parts determined in the manner already described.

To find the side elevation we have

$$\frac{\delta z}{\delta r} = \tan s \frac{- r \rho z \sqrt{\rho^2 - z^2}}{\rho^4 + (r^2 - \rho^2) z^2} \qquad \text{whence}$$

$$x = \cot s \left\{ \frac{r^2 - \rho^2}{r \rho} \sqrt{\rho^2 - z^2} + \frac{\rho^2}{r} \log \sqrt{\left(\frac{\rho + \sqrt{\rho^2 - z^2}}{\rho - \sqrt{\rho^2 - z^2}}\right)} \right\};$$

it is, however, more easily determined thus

$$\frac{\delta x}{\delta z} = \cot s \frac{r^2 + \rho^2 \tan \alpha}{r \rho \tan \alpha}$$

$$= \cot s \left\{ \frac{r}{\rho} \cot \alpha + \frac{\rho}{r} \tan \alpha \right\}$$

$$\text{But } \delta z = - \rho \sin \alpha.\ \delta \alpha. \qquad \text{whence}$$

$$x = - \cot s \left\{ \frac{r^2 - \rho^2}{r} \sin \alpha + \frac{\rho^2}{r} \text{ nep. l. tan} \left(45 + \frac{\alpha}{2}\right) \right\}$$

For the end elevation we have recourse to equation (P) which gives

$$\frac{\delta y}{\delta \alpha} = \frac{\rho^2}{r} \left\{ \sec \alpha - \cos \alpha \right\} \qquad \text{and thus}$$

$$y = \frac{\rho^2}{r} \left\{ \text{nep. log tan } (45 + \tfrac{1}{2} \alpha) - \sin \alpha \right\}$$

which is the equation of the tractory modified by the existence of the factor $\frac{\rho}{r}$. From this equation the determination of the individual point is most easily obtained.

I now proceed to consider the Parabolic Arch. f being the focal distance, the equation of the parabola is

$$u^2 = 4 f z, \text{ whence } u\, d u = 2 f d z$$

whence again the equation

$$v = \text{cse } s \left\{ u + \frac{u^3}{12 f^2} \right\}$$

which belongs to the horizontal projection; also

$$x = \cot s \left\{ 2 u + \frac{u^3}{6 f^2} \right\} \qquad \text{or}$$

$$x = \cot s. \frac{2}{3} \sqrt{f z} \left\{ 3 + \frac{z}{f} \right\}:$$

and also

$$y^2 = \frac{4 z^3}{9 f}$$

which are the equations of the three projections.

I have now run over the equations which serve to determine the different parts of oblique, circular, elliptic, and parabolic arches, and had intended to supply examples of the requisite calculations; but after proceeding to some length in this, it occurred to me that those who have followed the preceding investigations stand in no need of such illustrations, and that these, therefore, would merely occupy room without being productive of any benefit.

HARBOURS (SOUTH EASTERN COAST.)

A Copy of the Report of the Commissioners appointed to Survey the Harbours of the South-Eastern Coast, to the Lords Commissioners of the Admiralty.

WITH AN ENGRAVING, PLATE XII.

Having completed the inquiry on the subject of the Harbours on the South-Eastern coast of England, we request you will lay before the Lords Commissioners of the Admiralty the result of our investigation.

Mr. Wood's letter of the 25th of July last conveyed to us the directions of their Lordships "to visit the coast between the mouth of the Thames and Selsea Bill, and to examine and report on the state of the existing harbours between those points, with reference to their being available as places of shelter for vessels passing through the channel, in case of distress from weather, and also as places of refuge for merchant vessels from enemy's cruizers in time of war, and more especially as to their being made stations for armed steam-vessels employed for the protection of our trade in the narrow part of the channel;" for which purpose, the harbours being accessible at all times of tide, and their capability of defence, were stated to be most important considerations.

Their Lordships further desired us "to report as to what situations we would recommend as best calculated for these various purposes; whether in any of the existing harbours, or at any other places within the assigned limits; and also what works would be necessary to render them available; and what the probable expense of the undertaking would be."

Before entering into the details of the subject, it will be proper to state that a question arose whether it fell within the province of the Committee to offer any remarks on those harbours which were found on inspection to be incapable of access at all times of tide.

A perfect harbour of refuge, we understand to mean, such as is capable of receiving any class of vessels, under all circumstances of wind and tide.

Now there is no such harbour along the whole range of coast from the Nore to Selsea Bill; nor are any of the existing harbours capable, by any improvements or alterations to their present entrances, of being made accessible at low water even to the extent of six feet, with floating berthage inside.

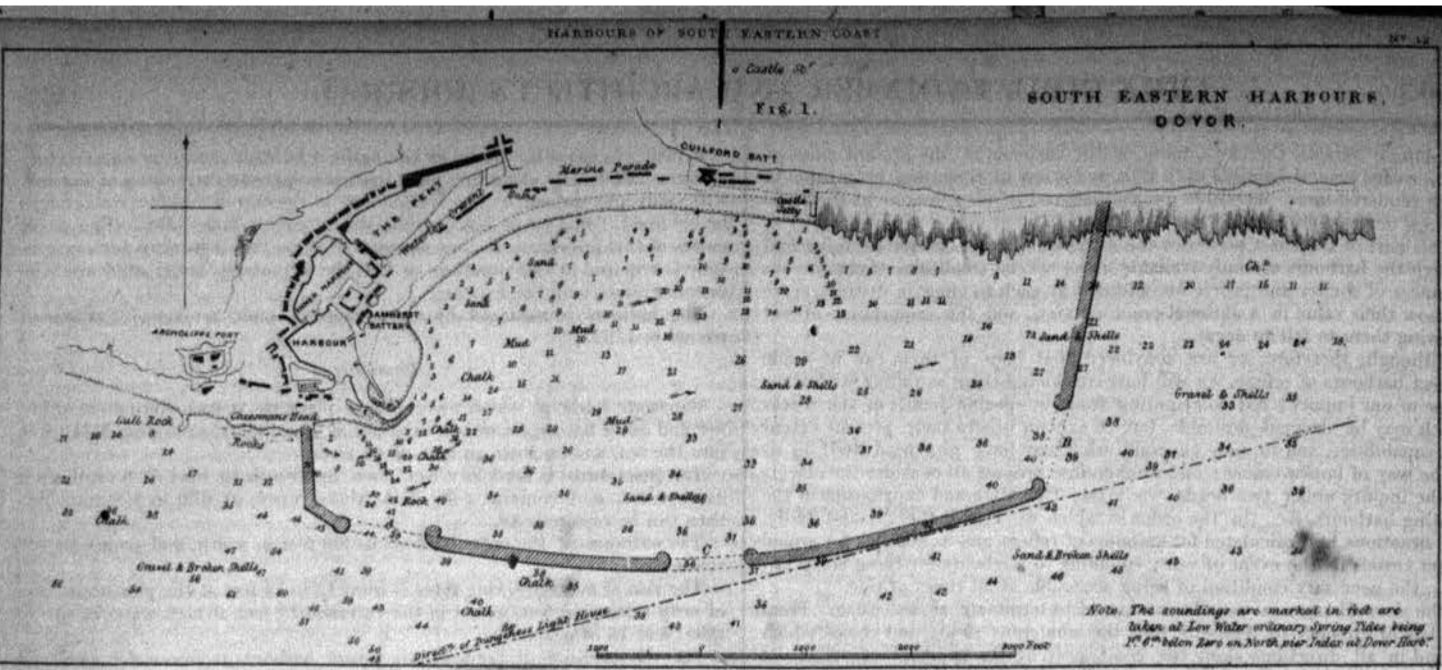
Most of the harbours on this part of the coast are formed by piers carried out from the main land, and are tidal harbours, dry or nearly so at low water, with bars at their entrances: these harbours would therefore be excluded from our consideration, if their capability of being made available at all times of tide was to be considered a necessary condition.

There can be no doubt, however, that the existing harbours are of importance to merchant vessels of the smaller classes at various times of tide, according to their draught of water; and though they may not be capable of receiving a large ship, may afford shelter to a smaller one; and thereby become a harbour of refuge to a class of vessels the most numerous and least prepared for heavy weather, or to escape an enemy in time of war.

The value of such imperfect harbours is also increased by the diminution of late years in the size of trading vessels. The large class of ships which were employed in the West India, and the still larger in the East India trades, have been succeeded by vessels of much smaller tonnage. The coasting and coal trades are carried on in vessels of comparatively light draught of water; and steam-vessels, whose draught is easy compared with sailing-vessels of equal tonnage, are rapidly increasing in number, and often supply the places of the larger class of vessels which were formerly employed in the merchant service.

Fig. 1.

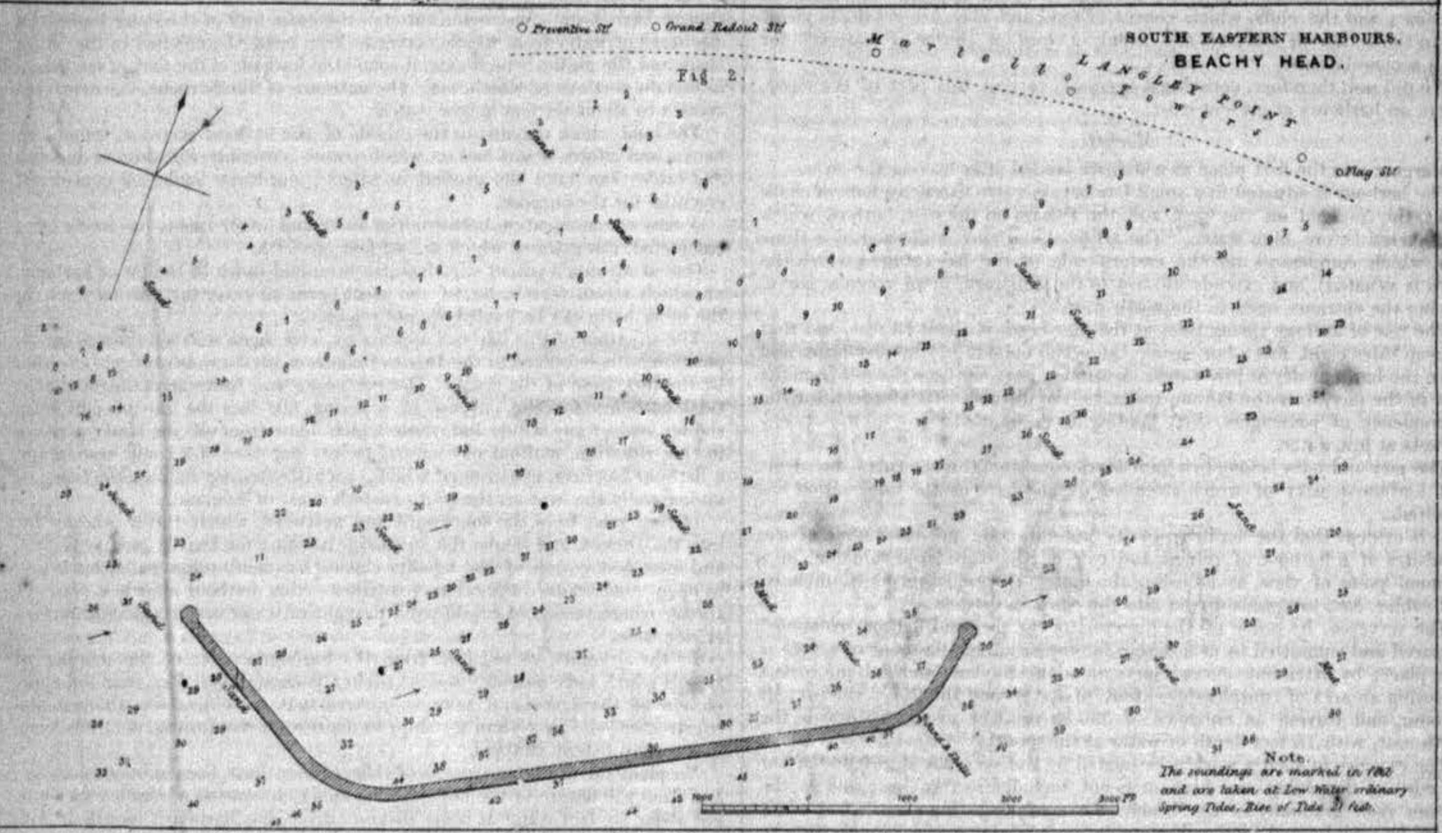
SOUTH EASTERN HARBOURS, DOVOR.



Note. The soundings are marked in feet are taken at Low Water ordinary Spring Tides being 1ft. 6in. below Zero on North pier Index at Dover Harbr.

Fig. 2.

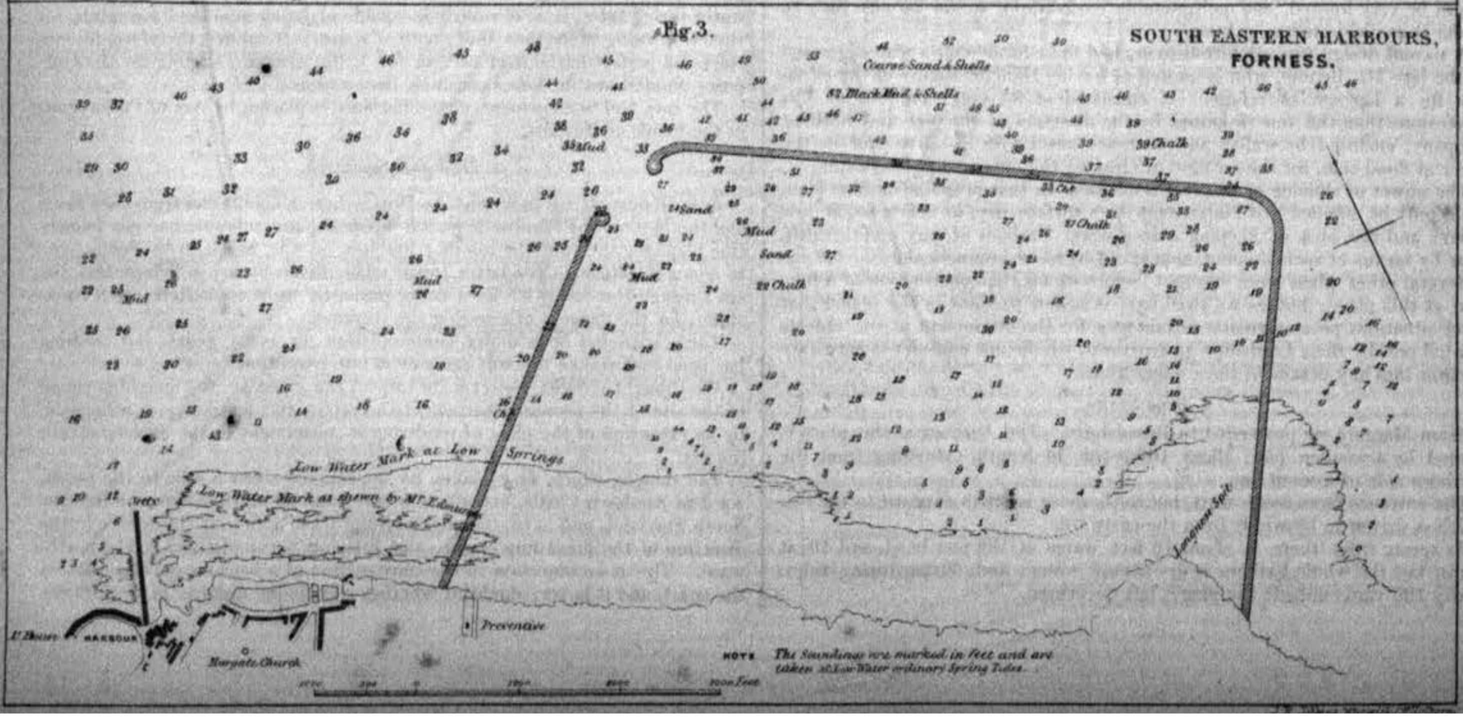
SOUTH EASTERN HARBOURS, BEACHY HEAD.



Note.
The soundings are marked in feet and are taken at Low Water ordinary Spring Tides. Rise of Tide 21 feet.

Fig. 3.

SOUTH EASTERN HARBOURS, FORNESS.



NOTE The Soundings are marked in feet and are taken at Low Water ordinary Spring Tides.

To these vessels, therefore, some of the harbours at the present moment are open for several hours of each tide, and a few of them may be capable of being rendered more accessible by the removal of obstructions at their entrances, or by additional works.

This part of the coast possesses the advantage of a good rise of tide; and though the harbours are only available under special conditions, the numerous instances of shelter and protection afforded by each to ships in distress, serve to show their value in a national point of view, and the importance of not allowing them to fall to decay.

Although, therefore, we are convinced that none of them can be made perfect harbours of refuge, we still have considered them as falling within the scope of our inquiry; not as requiring from us specific details of the works which may be deemed desirable, but to explain briefly their present extent and capabilities, and to note generally what may have presented itself to us in the way of improvement; and we therefore propose to consider the objects of the inquiry under two heads, viz.: 1st, The state and capabilities of the existing harbours, &c., (in the order in which we visited them); and 2ndly, The situations best calculated for harbours of refuge, and as stations for armed steam-vessels in the event of war; confining to harbours for these latter objects, the necessary condition of being accessible at all times of tide.

The river Thames is usually considered to terminate at the Nore. From the Isle of Sheppey to Westgate Bay, the numerous sands and shoals which extend in all directions along the coast, prevent the approach of vessels of any size; and the cliffs, which consist of sand and clay, are gradually yielding to the action of the sea, and supply a constant source of materials for fresh accumulations.

We did not, therefore, consider it necessary to visit this part of the coast, where no harbours at present exist.

Margate.

Margate was the first place at which we landed after leaving the river.

The harbour is situated in a small bay between two extensive flats of chalk rocks, the Nayland on the west, and the Fulsam on the east, both of which are covered before high water. The artificial harbour is formed by a stone pier, which commences on the eastern side of the bay (around which the town is situated), and extends 800 feet to the westward, in an irregular curve, leaving the entrance open to the north-west.

The rise of average spring tides at the pier-head, is about 13 feet, and that of neap tides eight feet; but spring tides ebb outside of the pier-head, and leave the harbour dry at low water. A wooden jetty has been run out from the root of the pier, over the Fulsam rocks, to the distance of 1,100 feet, for the convenience of passengers, &c., landing from or embarking in the steam-packets at low water.

The pier and jetty belong to a joint-stock company, the chairman, surveyor, and harbour-master of which attended us, and gave us the information we required.

It is evident that the harbour in its present state possesses none of the requisites of a harbour of refuge, and can only be considered valuable, in a national point of view, as affording the means of supplying pilots, anchors, and cables, &c., to vessels driven into the roads in distress.

The surveyor, by order of the directors of the pier and harbour company, prepared and submitted to us a design for constructing a harbour of refuge at this place, by extending curved piers upon the Nayland and Fulsam rocks; enclosing an area of considerable extent on and around the site of the present harbour, and leaving an entrance of 300 or 400 feet in width towards the north-east, with 16 feet depth of water at the mouth.

The expense of such a work is estimated by the surveyor at 275,000*l.*; but the cost of deepening the harbour is not included in this sum; and as the bottom rises gradually to the beach, the area possessing even 8 feet water would be very limited, and considerable excavations would be necessary to render it available to any extent.

A second design was submitted to us, said to be formed on a plan suggested by the late Mr. Rennie, who is quoted as having thought highly of the situation for a harbour of refuge. It consisted of an outer harbour of less dimensions than the one proposed by the directors of the pier and harbour company, enclosed by walls; and an inner basin with gates to shut in the water at flood-tide, for the purpose of clearing the entrance at low water.

The power of sluicing at so great a distance as that proposed in this plan, could only be applied with advantage to a surface dry, or nearly so, at low water; and the idea of keeping a deep-water harbour of any useful width, clear by means of such sluicing, appears to us to be impracticable.

Several other plans were brought before us for the construction of a harbour at this place; but as we shall have occasion to show in the sequel that other situations possess greater advantages for the attainment of the objects pointed out by their Lordships' instructions, we do not consider it necessary to enter into any details of these suggestions.

Broadstairs.

From Margate we proceeded to Broadstairs. The harbour at this place is formed by a wooden pier, about 100 yards in length, extending from the northern side of a small bay.

The entrance faces south-west, but the harbour is much exposed to the sea, which is driven in by winds from the eastward.

At spring tides there is about 16 feet water at the pier-head, and 10 at neaps, but the whole harbour is dry at low water; and, during spring tides, nearly 100 yards outside the pier is left uncovered.

A plan was submitted to us by the harbour commissioners for constructing a larger harbour, by extending piers from the opposite extremities of the bay, 320 yards into the sea, by which eight feet in the entrance at low water might be obtained. But we do not consider it necessary to enter into further particulars of this project, as it does not appear to us that a work of such magnitude is required in this situation, or that the advantages anticipated would be commensurate with the expense.

The harbour is managed by commissioners, under an Act of Parliament passed in 1792.

Ramsgate.

Ramsgate harbour, which was the next place we visited, consists of an inner and outer basins, formed by substantial stone piers, extending 1,310 feet into the sea, and encloses an area of 42 acres.

The inner basin is used as a wet dock for vessels to load or unload their cargoes, &c., and contains a dry dock where vessels of 300 to 400 tons burthen can be repaired, &c.

The entrance of the outer harbour is 200 feet in width, and opens to the south-west.

The rise of average spring tides is from 13 to 14 feet at the pier-heads, and of neap tides nine feet, giving in the entrance 19 feet at high water of spring tides, and 16 of neaps.

For the purpose of scouring the outer harbour at low water, powerful sluices have been constructed through the cross wall of the inner basin, the discharge of water from which serves to keep open the channel to the inner basin and the gullies which extend round the harbour at the foot of the piers, in certain portions of which, near the entrance of the harbour, the depth increases to about six feet at low water.

The mud which remains in the middle of the harbour serves as grounding banks, and affords a soft bed on which vessels entering with loss of anchors and cables can take the ground in safety; and these banks are considered essential for the purpose.

A new communication between the outer and inner basins has lately been completed, the gates of which are 42 feet in width.

One of Morton's patent slips has also been laid down in the outer harbour, on which steam-vessels, &c. of too great beam to enter the graving dock in the inner basin can be hauled up and repaired.

The situation of this harbour appears to have been selected more from its position with reference to the Downs than from any local advantages afforded by the formation of the coast. There is no natural backwater, so essential in tidal harbours for the purpose of scouring, nor does the line of cliff offer shelter against any winds but those which blow from off the land; and yet in this situation, without one natural facility but that of a chalk foundation, a harbour has been constructed which, notwithstanding its imperfections, is undoubtedly the best on the south-eastern coast of England.

During gales from the southward and westward, which throw a heavy sea into the Downs, and render the anchorage insecure for heavily-laden coasters, and merchant vessels of the smaller classes frequently unprepared for riding in open roadsteads during heavy weather,—this harbour affords a place of shelter where vessels of considerable draught of water may run for protection at tide time.

By the accounts we received from the harbour-master of the number of vessels which have annually sought shelter from weather, &c. since the completion of the harbour, it may be inferred that the object for which it was constructed, viz. an asylum for ships in distress in the Downs, &c., has been to a certain extent attained.

No plans for the improvement of this harbour have been submitted to us; and from the nature of the bottom outside, which consists of chalk rock, with not above six feet water at some distance from the harbour's mouth, at low water spring tides, it is obviously incapable of being rendered accessible for vessels drawing more than that depth of water. It cannot, therefore, be considered a perfect harbour of refuge, nor is the situation eligible for the purposes pointed out in their Lordships' instructions.

The care and management of the harbour is placed, by Act of Parliament, in the hands of trustees.

Deal and Sandwich.

From Ramsgate we proceeded to Deal, where a deputation from that town and the borough of Sandwich waited upon us, and submitted to our inspection plans for the construction of a harbour on the beach, with docks, &c., to communicate with the latter town. The River Stour, which enters the sea through the Sandwich flats, being proposed to be converted into a backwater, for the purpose of scouring the entrance.

The scheme has been under contemplation for many years, but nothing has been undertaken towards carrying it into execution.

We thought it right, however, to inspect the coast in the neighbourhood of the site of the proposed harbour, to ascertain the feasibility or otherwise, by an extension of the plan, of rendering it subservient to the objects of our inquiry.

The shingle, which first makes its appearance about a mile to the northward of Sandown Castle, extends in a vast bank along the shore towards the South Foreland, and is continually moving by the action of the waves in the direction of the prevailing winds, and forming accumulations to the northward. This is an objection to the construction of a harbour on this part of the coast, and it is very doubtful whether vessels in distress in the Downs could make use of one in this situation. These reasons appear to us to render the plan ineligible.

The situation to which we next directed our attention was the space within the breaksand, and the expediency of enclosing the "Small Downs" and the area within, by extending a breakwater along the sand, and a pier from the shore. The magnitude and extent, however, of such a work, which would require a breakwater and pier of upwards of five miles in length, the small depth of water at the northern entrance, and the uncertain nature of the foundation, induce us to abandon the idea of a harbour of refuge at this place.

Dover.

We next visited Dover. This harbour, from its proximity to the French coast, and as the principal port of communication between Great Britain and the Continent, has been regarded at all times as a place of the greatest importance.

We shall have occasion to refer to the situation in the latter part of this Report; and it will only be necessary in this place to give a brief description of the harbour in its present state.

It consists of an outer and an inner basin, with a backwater which opens into the latter, called the Pent.

The outer harbour contains an area of seven acres and a half, the inner basin six acres and a quarter, and the pent 11 acres and a half. A wet dock, of an acre and a half, opens into the western side of the outer harbour, which again communicates with a graving or repairing dock.

The entrance between the pier-heads (which are partly formed of stone and brickwork faced with wooden piles) is 110 feet in width, and opens to the south-south-east.

The rise of average spring tides is from 18 to 19 feet, and of neap tides from 12 to 13 feet; but the depth at high water in the harbour at spring tides is only 17 to 18 feet, and in the basin 16 to 17 feet, and about three feet less during the neaps.

The harbour is therefore left dry at low water.

The bottom consists of chalk, on which a deposit of mud in certain places has accumulated, but not of sufficient depth to enable heavily-laden vessels to take the ground with safety, especially during easterly winds, when, from the confined area of the outer harbour, and the rebound from the upright walls, there is a considerable agitation in the water.

During south-westerly gales, vessels experience difficulty in entering, from the heavy sea to which the harbour's mouth is exposed; and another formidable obstacle arises from the shingle bar, which winds from this quarter throw up across the entrance, and which at times has rendered the harbour inaccessible for several weeks together. Numerous plans and suggestions have been devised, and large sums of money expended for remedying this evil.

Formerly there were only three sluices or culverts, communicating by means of a pipe with the inner basin; but since 1837, a new and expensive work has been completed, consisting of a brick reservoir in the western pier, communicating, by means of a tunnel 30 feet in width and 16 in height, with the inner basin and pent. From this reservoir, five new sluices, seven feet in diameter, lead to the extremity of the pier-head; and from the powerful volume of water thus discharged, and the impetus acquired by the proximity of the reservoir, it has generally been found sufficient, with the assistance of the sluices in the cross wall, between the basin and outer harbour, to remove the shingle from the pier-head, and keep the channel clear to a level below that of the harbour's bottom.

We have been informed that since the construction of this work until January last, no instance occurred of Her Majesty's steam-packets being prevented from entering the harbour at tide-time, in consequence of the bar. But during the violent gales which took place in the latter end of the month of January and beginning of February in this year (1840), the Government packets were ordered to proceed to the Downs, to avoid the liability of being shut into the harbour by an accumulation of shingle and the heavy sea at the entrance. There were, however, but three days during which vessels were actually excluded.

It should be observed that these sluices, though efficacious to a certain extent, are not capable of removing the obstruction altogether. The force of the water, which at its exit from the culverts is very great, loses its impetus as it spreads over a larger surface, and forces the shingle to a comparatively small distance, where it is liable to form banks beyond the power of the sluices.

With regard to the improvements which might be made to this harbour, it appears to us that the general enlargement of the harbour, the inner basin and pent, and the widening of the internal communications, would be most desirable, as well as the extension of the stone groin, called Cheeseman's Head, on the western side of the harbour's entrance. But these suggestions, so far as regards the entrances, will be much modified in the event of a harbour of refuge being constructed at this place.

Various plans and suggestions for the improvement of the present, as well as for the formation of a new harbour, were submitted to us by Colonel Williams, Lieutenant Worthington, Mr. Jeffery, Mr. Stuart, Mr. Tait, Captain Meriton, and several other gentlemen; but as we shall have occasion to recommend a plan for the attainment of the objects of our inquiry, in the subsequent part of this report, we do not consider it necessary to enter into the details of these propositions.

The harbour-master and other officers of Dover, and pilots belonging to this, as well as to the other Cinque Ports, waited upon us by order of his Grace the Lord Warden, and gave us any information we required.

The habour is managed by commissioners, of whom the Lord Warden is chairman, *ex officio*.

Folkstone.

From Dover we proceeded to Folkstone. This harbour was constructed under an Act of Parliament in 1809, by a joint-stock company, to whom the property belongs, but at present it is in the hands of the Exchequer Bills Loan Commissioners.

The harbour, which is entirely artificial, is formed by rubble-stone piers, and encloses an area of 14 acres. The western arm extends in a south-south-west direction 140 yards across the beach, and is united with the main pier, which is carried in a straight line east and by south about 317 yards. A projecting pier has since been run out from the shore, on the eastern side, towards the south-west, 236 yards, leaving an entrance of 123 feet in width, open to the east and by south.

A groin has been constructed near the eastern extremity of the main pier, which extends at right angles 130 feet seaward, for the purpose of preventing the shingle from obstructing the harbour's mouth. This, however, has not overcome the evil; for the shingle having accumulated along the southern side of the main pier to the line of extension of the horn, finds its way round the extremity, and creates a bar nearly across the entrance.

The rise of spring tides averages about 18 to 20 feet, and neap tides from 12 to 14 feet, but the harbour is left dry at low water; and the greater part of the interior is blocked up by a bank of shingle rising to the height of several feet above high water, and leaving only a channel of inconsiderable width along the side of the main pier.

A small stream is pent up at the north-western side of the harbour, for the purpose of scouring at low water; and with the assistance of manual labour, in addition to this very inadequate backwater, the channel is kept open so as to allow vessels of 10 to 12 feet draught to come alongside of the main pier at the top of high water.

This harbour, in its present form, is not capable by any improvements of being made available for the purposes of our inquiry, and we do not consider the situation eligible for the construction of a deep-water harbour.

From Folkstone we proceeded to Hythe, and inspected the coast to Dungeness, No harbours at present exist between these places, and from the nature of the coast, the situation is inapplicable for their formation; but several plans having been submitted to us for the construction of a harbour at Dungeness, we landed for the purpose of examining the beach, and ascertaining the practicability or otherwise of the propositions.

Vice-Admiral Sir Edward Owen, in a communication which he subsequently addressed to the Committee, stated, that "during the late war, when the presence of the flotilla and the encampment of troops on the opposite coast demanded unceasing vigilance, and the employment of many armed cruisers of the smallest description, the inconvenience of sending these vessels to Sheerness for the purposes of trivial repairs, and payment of the men, &c., was greatly felt, both in the loss of their immediate services, and from the interruption to the more regular and important arrangements of defence; and Dungeness being then considered the rendezvous of greatest moment, he contemplated the formation of a basin within the shingle, in a position between No. 2 battery on the east, and No. 4 battery on the west, with an outlet on either side, by which vessels might enter or put to sea when their services were required."

The propositions submitted to us by Mr. Potter and Mr. Douglass were of a similar nature; and there can be little doubt, from the prominent position of this extensive point of land, and the anchorage it affords to vessels on either side, according to the direction of the wind, that the situation is desirable for a harbour.

The shore at the southern extremity is extremely steep, and descends at once into deep water; but the whole promontory consists of vast accumulation of shingle, constantly increasing and extending seaward; and were a basin to be constructed in the centre, the entrances on either side would speedily be choked up, and, in our opinion, no scouring power would be able to keep the channels clear below the level of low water. However desirable, therefore, the construction of a deep-water harbour may be in this situation, the physical obstacles to its formation and maintenance appear to us to render the scheme impracticable.

In corroboration of this opinion, and the constant motion and increase of shingle, it is worthy of remark, that the site of the present lighthouse, when first erected in 1792, was only 100 yards from the sea, and now, in the lapse of 47 years, the beach has extended 118 yards to the southward, leaving the lighthouse 218 yards inland.

The former lighthouse, which was pulled down when the present one was completed, was at that time upwards of 640 yards from the extremity of the Ness.

Rye.

Rye, which was the next harbour we visited in our progress round the coast, is situated in the bight of the bay formed by Fairlight Head, on the western side, and Dungeness on the eastern. The harbour is formed in the channel of the river Rother, at the point where it enters the sea, after receiving the waters of the Tillingham and the Bride, two small rivers which unite with it near the town of Rye, A wooden pier of piles has been constructed on the eastern side, and embankments have been thrown up on the western side, leaving an entrance between of 160 feet in width.

The average rise of spring tides is about 17 feet, and during neap tides from 9 to 12 feet at the pier-head, whilst the lift in the bay is 22 feet. At low water the harbour is left dry.

The depth of the channel up the river decreases gradually to the town, where there is 14 feet water at the top of spring tides, but during neaps seldom above nine feet.

The approach from the bay to the entrance of the harbour is very intricate and difficult, especially to sailing vessels, arising from the sandbanks and the tortuous course of the channel.

The shingle, which extends on both sides of the harbour's mouth, is accumulated at the entrance with winds either from the westward or eastward of south, and forms banks on either side (according to the prevalence of the wind), which, in combination with sand, serve to block out the sea, and render the channel crooked and uncertain.

There can be no doubt that these natural causes have mainly contributed to the deterioration of this port, formerly of greater capacity, and a place of importance; but at the same time it should be observed, that the encroachments which have been made from time to time on the original extent of the river, have proved a powerful cause of injury. Individuals interested in the maintenance and improvement of the harbour are fully aware of this fact, and the contests which arise on the subject of drainage, between the landowners and those concerned in the navigation of the river, have become a fruitful source of litigation. Extensive low lands over which the river formerly flowed at high water, have been reclaimed for the purposes of agriculture, and the powerful backwater which was thereby acquired, and operated as a scour during the ebb to clear the channel and keep the entrance open, has been diminished, and at the present moment is almost destroyed, by the erection of sluice-gates across the river, a little distance above the town, for the purposes of draining the lands at low water, and of preventing the flow of water up its natural channel, which, if not thus obstructed, would again inundate the lands below the level of high water.

No cause has operated more extensively to injure the entrances of harbours of this country, than excluding the tidal waters from lands below the level of high water, which served as natural reservoirs at flood tide, and were the means of affording a powerful discharge during the ebb. The portion of the river between the embankments formed for the purpose of excluding the high water, is often benefited by the contraction of the channel, and the consequent acceleration of the current, but the communication with the sea below such embankments is injured, and nothing more deserves the vigilant attention of Government, or of the parties entrusted with the conservancy of harbours, than the subject of encroachments, which are usually made gradually and silently, as dictated by private interest, and are difficult afterwards to remove.

At the present moment a stone wall is in progress of erection from the eastern pier-head, and is intended to be carried out as far as low water, across the extensive flats which form the bar at the entrance, in a south-half-east direction. By this means the water, which on its exit from the harbour spreads over the sandbanks and forms a crooked passage as it meets with obstructions, and is deflected from side to side, will be directed in a straight line; and there can be no doubt that the continuation and completion of this stone groin will render the navigation of the entrance less difficult, and at the same time enable vessels of greater draught of water than at present to enter at tide-time.

By straightening and deepening the channel up to the wharfs or quays at the town, a considerable improvement may also be effected; but from the limited means at the disposal of the commissioners, it will necessarily take a long time to complete these works.

Hastings.

No harbour at present exists between Rye and Newhaven; but the construction of one at Hastings having been frequently contemplated, we visited that town. The mayor and other gentlemen of the place attended, and laid before us several plans which had been prepared for the purpose; and Colonel Williams, late of the Royal Engineers, afforded us much information, together with his suggestions on the subject.

We do not, however, consider it necessary to enter into the particulars of these plans, as a few remarks will show the unfavourable nature of the situation for the objects of our inquiry.

The coast runs, with little deviation, in a straight line, nearly east and by south, and west and by north, and is entirely exposed to the prevailing southerly and westerly winds. There is no natural backwater, nor the facility of making an artificial one to any useful extent; the shore composed of shingle, and not above four fathoms water at a distance of three quarters of a mile from the beach, which would give but a limited area of 12 feet water (at low water), in proportion to the size of the harbour, were piers to be carried out to such an extent.

A small tidal harbour for the use of trading vessels, &c. would, no doubt, be a valuable adjunct to the town and neighbourhood, but we do not consider the situation adapted for any national work.

Cuxmere Haven.

At Cuxmere Haven, which is situated on the western side of Beachy Head, there is no artificial harbour. The shingle beach crosses the entrance and rises several feet above low water, and the interior of the haven is left dry at three-quarters ebb. We did not consider it necessary to land at this place, but proceeded round the coast to Newhaven.

Newhaven.

The harbour of Newhaven is formed in the channel of the river Ouse, at its entrance into the sea, by wooden piers carried out in a southerly direction across the beach. The river is navigable as far as the town of Lewes, and open to the flow and ebb of the tide for four miles further up the stream, or twelve miles altogether, and affords a powerful backwater for scouring the entrance.

The average rise of spring tide at the harbour's mouth is from 19 to 20 feet, and of neap tides about 14 to 15 feet. The bar, however, is left dry at low water spring tides, but within the piers there is about two feet water at such times, and this depth continues uniform for a mile up the channel.

The distance between the pier-heads is only 106 feet. On the western side of the harbour, the wooden pier, which extends about 250 yards, has been continued inwards by a stone embankment nearly three-quarters of a mile in a straight line; and the bar, which formerly extended from the western side nearly across the mouth of the harbour, has been considerably reduced since the completion of this work, the extension of the eastern pier, and other improvements which have of late been made in straightening and deepening the river above the town.

During the flood-tide and fine weather the harbour is easy of access, from the indraught and eddy-tide which set towards the mouth; but from the rapidity of the stream during the ebb, it is not considered safe for a sailing vessel to enter, and the flag at the pier-head is in consequence lowered at high water.

This harbour appears to be one of considerable value, and to possess facilities for further improvements; and there can be little doubt that an additional depth of water might be obtained by the adoption of judicious measures.

The observations we had occasion to make on the subject of encroachments, when treating of Rye, are equally applicable to this harbour; but great care should be observed, in straightening the river, to exclude the waters only from such places as afford a loose soil and serve to slit up the channel.

The piers at present only extend to the line of low water on the beach; and to render the harbour more available, it would be advisable to continue them some distance into the sea, and at the same time, by deepening and enlarging the river above the harbour, a larger body of water would flow up at tide-time, and give a commensurate discharge on the ebb. A dock or pent might be constructed on the low ground on the western side, between the entrance and the town, called Sleeper's Hole; and a groin extended from Burrow Head into the sea, would facilitate the ingress and egress of vessels, by protecting the harbour's mouth from the swell occasioned by south-westerly winds, and serve to keep off the approach of shingle to the entrance. The expense, however, of these works cannot be stated without previous minute surveys, &c.

The harbour is managed by trustees.

Shoreham.

Shoreham, at the mouth of the river Adur, was the next harbour we visited.

The river, which formerly entered the sea nearly at right angles with the line of coast, has been gradually diverted from its original exit by the shingle, which constantly travels from the westward, and until a few years ago flowed along the shore in an easterly direction for three or four miles, before it at length found its way through the shingle bank into the sea.

This accumulation of shingle, consolidated by the alluvial deposit from the river, now forms an embankment between the river and the sea, varying from 200 to upwards of 300 yards in width; and an area of considerable extent is left within, into which the sea flows.

The entrance which existed at the eastern extremity of this estuary, once the river's mouth, has been blocked up, and an artificial channel has been cut through the shingle embankment about a mile from the town of Shoreham. This opening is preserved by wooden piers (formed of piles), 218 feet apart, which run in a south-south-west direction across the shingle into the sea. Within this entrance a third pier has been built out from the shore nearly across the harbour, for the purpose of directing the waters on the ebb, from the eastern and western sides of the inlet, directly to the mouth. The great body of water which thus ebbs and flows through the entrance serves to keep the channel open; and though the width is so considerable, the stream runs between the pier-heads at the rate of five or six miles an hour. The harbour's mouth is nevertheless subject to a bar, which rises occasionally above the low water level, and shifts its position from 60 to 160 feet from the pier-heads.

The lift of spring tides is about 15 feet, and neaps about nine feet. The depth of water over the bar at high water is from 14 to 17 feet, according to the tides and state of the bar.

From its proximity to Brighton, this harbour is of importance to the local trade. We were informed that upwards of a thousand vessels enter annually. It is capable of improvements; the most obvious of which are, the extension of the present piers and the filling in of their centres with rubble, which are now partly open, and admit the shingle into the entrance.

The interior of the harbour might, at the same time, be deepened and generally improved, but we do not consider it capable of being converted into a deep-water harbour for the purposes pointed out by their Lordships.

The harbour is the property of a joint-stock company, established by Act of Parliament.

Littlehampton.

Littlehampton, which is the next harbour on the coast, is formed by the channel of the river Arun, which is led in a southerly direction into the sea, between two piers, composed of piles, with an extension of dicker-work.

The depth of water in the entrance between the piers is two to three feet below the level of low water, but a bar extends outside the dicker-work, across the mouth, which rises about two feet above the general surface, and is left dry at low water.

The lift of average spring tides about 16 feet, and of neaps 11 feet.

The larger vessels which enter usually remain near the river's mouth, at Littlehampton; but a vessel of 13 feet draught, when she has passed the bar, can proceed to Arundel Bridge, a distance of six miles, the bottom continuing of an uniform level throughout that extent.

The tide flows nearly 25 miles up the river, but the backwater thereby afforded proves of little value, in consequence of the narrowness of the channel and the sluggishness of the stream. It is scarcely necessary to add, that the harbour is not available for the objects of our inquiry, and the shoalness of the water on this part of the coast renders the situation inapplicable for any national undertaking.

The harbour is under the management of trustees.

Pagham..

Pagham was the last place we examined; it consists of low ground of very considerable extent, over which the tide flows at high water, and is entered by a crooked channel which continues some distance inland; vessels of 40 tons and under, with coals or manure, are the only traders to the place.

There is no artificial harbour, and the situation is not deserving of attention.

General Remarks.

Having now completed our remarks on the state and capabilities of the existing harbours, &c., it is evident that there is no port at the present moment between Sheerness and Selsea Bill which can be considered an available harbour of refuge at all times of tide, or that possesses the capability of being rendered efficient for such a purpose, by any improvements or alterations which could be made.

We proceed, therefore, in conformity with their Lordships' instructions, to point out the situations which, in our opinion, are best calculated for stations for armed steam-vessels during war; and the works necessary to render them available for such a purpose, and at the same time to combine all the objects for which refuge harbours are so much required for the security of shipping navigating this part of the Channel.

We are decidedly of opinion that deep-water harbours on this part of the coast must be formed in the sea by means of breakwaters detached from the main land, on the same principle as that in Plymouth Sound, or connected with the shore by piers similar to the harbour at Kingstown, near Dublin.

The situation which appears to us to be of the greatest importance, and at the same time offers the most eligible position for a deep-water harbour, is Dover Bay. Independently of its proximity to the Continent, this bay possesses considerable advantages: the depth of water at 400 yards from the shore, is two fathoms at low water of spring tides, and but six fathoms at 1,100 yards; which therefore affords a sufficient width for the construction of a capacious deep-water harbour, without getting into such a depth for the site of the piers or breakwater as would add greatly to the expense of the works. The principal feature of the proposed plan is a breakwater, at the average distance of 1,000 yards from the shore, with piers projected from the land towards its eastern and western ends, leaving one or more entrances, as shown on the plan, Fig. 1, at A, B, and C.

These piers and breakwaters to consist of large blocks of the hardest chalk rock, with a thick covering of stone, either granite or hard limestone.

The space between the piers, or length of the harbour, as shown upon the plan, is 2,300 yards, and the area enclosed would comprise 450 acres,* of which 320 would have from six to two fathoms at low water, and 130 acres under two fathoms. The breakwater may be connected with the east and west piers, and have but one entrance in the middle (C), 600 or 700 feet in width; or it may be detached from the piers, so as to leave an entrance (A) nearly opposite the present harbour, and another opening (B) at the eastern end.

The advantages of two entrances, one at the eastern and the other at the western end, instead of one only in the centre, would be that vessels might enter or leave the harbour with the wind from any quarter, and a ready access be afforded to the mouth of the present harbour from the western entrance, without passing through the centre of the new harbour.

On the other hand, one entrance in the middle would have the advantage of rendering the interior of the harbour in some degree quieter than with two entrances.

On consideration of the subject, our opinion is in favour of the two entrances at the east and west ends; but the decision of the question need not delay or interfere with the execution of the work, as it might be proceeded with along its whole extent (with the exception of the entrances), and the result of the advantages, or otherwise, be tested by actual observation.

As a second place for a harbour of refuge, we recommend the bight to the eastward of Beachy Head and westward of Langley Point, and the formation there of a detached breakwater curved or in kants, the main body running nearly parallel with the shore, leaving entrances to the eastward and westward, to enable vessels to sail out or in with any wind (Fig. 2).

There is a sufficient depth of water near the shore, and but a small increase of depth for a considerable way out; affording a large harbour space, and facility for the formation of the necessary works. Looking at the locality as nearly equidistant from the South Foreland on the east, and the harbours and anchorages within the Isle of Wight on the west, and to its relative position with many harbours on the opposite shore; also to its proximity to the elevated promontory of Beachy Head; we think it offers important advantages, both as an asylum harbour and station for armed steam-vessels.

The breakwater, if built in five fathoms water, and one mile from the shore, would give a width of about half a mile, having in no part less than two fathoms depth at low water; the area of course depending on the length.

One and a half mile of breakwater, including the arms, would give shelter over 450 acres of surface.

The third and last situation we recommend for a harbour of refuge, is under the chalk cliffs to the eastward of Margate. The Chalk Bank and Longnose Spit stretch out to the north-east from Foreness Point: upon this site we propose a pier to commence at the shore, and to be extended 1,000 yards clear in a north-north-east direction; thence to turn west-north-west for a length of 2,000 yards; terminating in a round end, to form the northern head of the entrance. The western pier to be carried out from the shore in nearly a north-east direction, and be the same length as the east pier.

This would enclose a harbour of 460 acres, of which 352 acres would be not less than two fathoms, increasing to six fathoms, and 108 acres would be under two fathoms at low water.

The entrance opening in a north-westerly direction would receive the protection of Margate Sand, and an opening in a west-north-west bearing would also permit vessels to sail in with winds from the south round westward to north-east, and out with winds from the north round eastward and southward to south-west. And in extreme cases, when the harbour could not be entered by sailing vessels, shelter would be given them under, or to the eastward or westward of it.

The construction would be, as at Dover, a core of chalk blocks from the adjoining rocks, faced with stone.

The advantages of this situation will be apparent when it is remembered that our eastern coast is literally without shelter from easterly winds for vessels of any magnitude.

A harbour off Foreness must, therefore, be regarded as one of refuge for vessels stationed in the North Sea, and would more particularly have reference to every thing connected with the opposite ports eastward of Calais.

For the mercantile marine, especially, navigating the northern part of the English Channel, the situation would be most desirable; inasmuch as vessels bound to the westward from the river Thames or the North Sea, arriving off the North Foreland, and then finding the wind strong from the southward and westward, would, in order to avoid anchoring in the Downs, and the liability to accidents which so frequently occur there in south-westerly gales, gladly avail themselves of the shelter which this harbour would afford.

To vessels, also, caught in the Downs by tempestuous weather, or having received damage, a harbour off Foreness, accessible at all times of tide, would prove an invaluable asylum, where heavily-laden ships would escape the danger of grounding; and a considerable fleet of such vessels would lie in perfect security from storms or an enemy, until a change of wind would enable them to proceed down Channel.

Similar advantages would be experienced during easterly winds, by vessels from the westward, bound to ports upon the east coast; whilst to steam-vessels the harbour would be accessible in all winds and weather.

The cost of each of the three harbours of refuge we have recommended, may be taken as nearly equal; none of them less than £2,000,000 sterling, nor much exceeding that sum. An addition of a quarter of a mile to the length, would give an increased area of 100 acres, and would add about £300,000 to the estimated expense of each harbour.

We have not considered it necessary to enter into any details as to the defences which might be required to these places of refuge, but there can be no doubt of the practicability of rendering them secure.

The introduction of steam navigation will render a rapid communication along the coast an object of far greater importance than heretofore; and we consider that railways along the coast, on each side of Dover, may be made extremely useful in sending support in the shortest possible time to any point where the presence of troops may be required.

We have, &c.

(Signed) **James A. Gordon**, Rear-Admiral.
Alex. T. E. Vidal, Captain.
Robert Thomson, Lieut.-Col. R. E.
Richard Drew, Elder Brother of Trinity-house.
J. Walker, } Civil Engineers.
W. Cubitt, }

30th May 1840.

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* Kingston Harbour is 220 acres.

RAILWAY COMMUNICATION WITH SCOTLAND.

Second Report of Lieut.-Colonel Sir Frederic Smith, of the Royal Engineers, and Professor Barlow, to the Lords of the Treasury, in pursuance of the Addresses of the House of Commons, of the 14th and 20th August, 1839.

Railway Committee Office,
5, *Committee Room, House of Commons,*
May 16, 1840.

Sir—The instructions of the Lords Commissioners of the Treasury, communicated to us in your letter of the 26th November, 1839, having directed that we should examine and report upon the surveyed and projected lines for a railway communication between London and the cities of Edinburgh and Glasgow. in conformity with the address of the House of Commons, dated the 14th of August, 1839, we entered upon this inquiry immediately on receiving from the promoters of these lines the documents which had been prepared for the investigation.

The address to which we have referred prays "that her Majesty will be pleased to give directions that an engineer, or engineers, may be appointed to inquire and report upon the relative merits, and the preference which ought to be given to the respective already surveyed and projected railways between London and the cities of Edinburgh and Glasgow, following, namely, viâ York, Newcastle-upon-Tyne, and Berwick; viâ York, Newcastle-upon-Tyne, and Hexham; viâ Lancaster, Whitehaven, and Carlisle; and viâ Lancaster, Penrith, and Carlisle; and said inquiry and report to include the relative merits of the two lines, from London to York, by Derby and Rotherham, and by Cambridge and Lincoln."

The investigation entrusted to us divides itself into two branches; the one being the relative merits of the competing lines between London and Edinburgh, and the other, of those projected between London and Glasgow.

Their lordships having granted an extension of time to the promoters of certain lines north of the Carlisle and Newcastle Railway, for the purpose of enabling these parties to render their surveys more complete, and some of the documents necessary for testing the relative merits of the proposed lines of communication from London to Newcastle not being ready for our examination, we have devoted our attention principally to the subject of the communication between London and Carlisle, and to the merits of the Cumberland railways, as regards their connexion with the western parts of Scotland, and the north of Ireland, to which our attention is called by the address of the House of Commons, dated the 20th August last, and we have now the honour to report the result of our inquiries.

It appears that by the London and Birmingham, the Grand Junction, and the North Union lines, the communication by railway is complete as far as Preston, being a distance of 218 miles 51 chains, and we find that the Preston and Lancaster Railway is in a state of great forwardness. When this last-mentioned line shall be finished, the distance by railway from London to Lancaster will be 238 miles 69 chains.[*]

Description of the competing Projects.—Three projects were laid before us for the extension of this great trunk line to Scotland.

One from Lancaster, along the west coast of Cumberland, through Whitehaven to Maryport, in order to join the railway now in progress between the latter place and Carlisle.

Another from Lancaster by Kirkby Lonsdale, and the valley of the Lune to Penrith, and from thence to Carlisle; and a third from Lancaster to Kendal, and thence up the valley of Long Sleddale, and by Hawes Water to Penrith, to form a junction with the proposed railway from the last-mentioned place to Carlisle.

West Cumberland Coast line.—The documents respecting the Cumberland coast line, delivered to us by the solicitors, Messrs. Haslam and Bischoff, and the engineers, Messrs. Rastrick and Hague, are copies of their parliamentary plan and section; drawings descriptive of the proposed mode of forming the embankments across Morecambe Bay, and the Dudden Sands, and a general plan of the country through which the line would pass. We were also furnished with a printed copy of a report on this project, by the engineers, and with a detailed estimate, formed by Mr. Hague, of the cost of the embankments.

The whole of the drawings illustrative of this project have been prepared in a very perfect and creditable manner, and have much facilitated our examination of the country.

Penrith and Carlisle line.—Mr. Larmer, the engineer, and Mr. Dixon, the secretary to the provisional committee of a Company for forming a railway from Carlisle to Penrith, supplied us with a section of this line, and a map of the county, on which the proposed route is traced.

Lune line.—We may here observe, that if this railway should be formed, it would be connected, at its southern terminus, with either of the inland lines that may be established from Lancaster. Mr. Larmer not only surveyed and projected the line from Carlisle to Penrith, but also that from Penrith to Kirkby Lonsdale. The line from the last-named place to Lancaster, we were informed, was laid down by persons under the direction of Mr. Locke, but the sections of the whole extent between Penrith and Lancaster, and tracing of it on maps of Cumberland, Westmoreland, and Lancaster were placed before us by Mr. Larmer, by whom we were also furnished with an estimate of the cost of the entire distance from Lancaster to Carlisle, and a report descriptive of this project.

Kendal line.—From Mr. Cornelius Nicholson, secretary to the provisional committee for the Kendal line, we received a section of this proposed railway, and a map of Westmoreland and a part of Lancashire, on which the direction of the line is traced. The survey, as well as a gross estimate of the cost of the line, were prepared by Mr. Bintley, of Kendal, by whom a report respecting it was drawn up, which will be found in the appendix.[*]

In the course of our examination of the documents submitted to us, we found that, with the exception of the drawings and report of the coast line, they were insufficient for the purpose of fairly testing the relative merits of the several projects now under consideration, and we therefore called for further information, not only as to their mechanical, but also as to their statistical properties. This information having been in part supplied on the 18th February, we commenced on that day an examination of the country through which these projected railways would pass, and we shall now give a general description of their principal features, beginning with the Cumberland coast line.

Cumberland Coast line.—It is proposed that this railway should commence at the terminus of the Lancaster and Preston Railway, and that, curving round towards Skirton, it should first cross the Kendal Canal, and then the River Lune; the latter on a bridge, the arching of which is represented by Mr. Rastrick to be 660 yards in length, and of the extreme height of 67 feet above the bed of the river. From Skirton the line is to proceed by Torrisholme to the village of Poulton; from hence it would be carried, in the direction of Leonard's Point, in the peninsula of Low Furness, on a lofty embankment of 10 miles and 51 chains in length, to be constructed across the estuary of Morecambe Bay, into which the Kent, the Crake, and the Leven empty themselves. Through the peninsula the railway would have to be formed in a line of double curvature, and in some deep cuttings in sandstone rock. It is also proposed to form an embankment across the Dudden Sands, from Ronhead Crag to Hodbarrow Point, a distance of one mile and 65 chains. These embankments are understood to be the suggestions of Mr. Hague, whose plan provides locks and flood-gates for the rivers, the channels of which he proposes to straighten and embank. It is here proper to state that the promoters of this line calculate upon reclaiming by the two embankments 52,000 acres of land, which they value at 23*l.* per acre, and they have therefore taken credit for £1,196,000 in the estimate of this part of their project.

From Hodbarrow the line would pass near Bootle to Ravenglass, through a country presenting no engineering work of difficulty or great expense until arriving at the River Esk, where a viaduct will be necessary of upwards of a quarter of a mile in length, and of 23 feet in the extreme height, approached by an embankment of about a mile in length, and of the average height of 15 feet.

The line is to curve at Ravenglass, passing the rivers Esk and Mite, and to take a direction towards the coast, crossing the river Calder at its mouth. It is also to be carried over the river Ehen, and thence to keep along the shore, requiring the occasional formation of embankments, between high and low water mark, to the valley of St. Bees. Here a curve is proposed towards the north-east to unite with one bending towards the north-west, which would bring the line, with tolerably easy work, to Whitehaven. It is proposed to carry the railway through the whole length of this town, on a series of arches, which Mr. Rastrick's section shows to be of the extreme height of 27 feet, and of the length of half a mile. On leaving Whitehaven a tunnel of 1,320 yards in length would have to be cut through sandstone. The line is from hence to pass towards Harrington, along the coast, through some short, but rather deep cuttings, and over four embankments, measuring altogether two miles in length, and of the respective heights of 18, 23, 27, and 34 feet.

Mr. Rastrick's plan is to cross the upper end of the harbour of Harrington by a bridge, which his section shows to be 120 yards long, and 27 feet high.

From hence the line is intended to take the direction of Workington, and to cross the harbour, as well as the Derwent river, on bridges and embankments.

From the Derwent to the terminus of the Maryport Railway, with which Mr. Rastrick's line is proposed to be joined, the work will be easy.

Expensive, or objectionable parts of the Cumberland Coast line.—The operations of an expensive, difficult, or objectionable character on the coast line, which we have thus briefly described, are as follows:—

1. The bridge over the river Lune.
2. The embankments across Morecambe Bay and the Dudden Sands, with the embankments to confine the courses of the rivers which empty themselves into these estuaries.
3. The cuttings in rock through Low Furness.
4. The viaducts and embankment across the rivers Esk and Mite, and over the sands at Ravenglass.

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[*] If a line should be formed from Rugby to Stafford, or from Rugby to Stone, the distance would be shortened by about eight miles.

[*] We must observe, that the report omits to mention some of the expensive operations on this line, and but slightly notices other important works involved in Mr. Bintley's project; and we cannot help expressing our surprise that he should have stated that the proposed tunnel through the Gate Scarth, which the highest geological authorities represent to be composed of green slate and porphyry, could be formed at the rate of £50,000 per mile, a sum which is totally inadequate to cover the cost of so formidable an undertaking, particularly as the summit is nearly 1,200 feet above the tunnel.

5. The very extensive demolition of houses at Whitehaven, and the formation of viaduct of half a mile in length through that town.

6. The tunnel to the north of Whitehaven.

7. The crossing of Harrington Harbour, and the injury which would thereby be caused to that port, and

8. The crossing of Workington harbour, and the Derwent river.

To these may be added, the stoppage of the Ulverstone trade during the formation of the river channels, and a part of the Morecambe Bay embankment.

Although each of these operations would be attended with considerable expense, none of them presents what may be termed, great engineering difficulties, excepting the embankments of Morecambe Bay, and the Dudden Sands; but these are works of an extraordinary character and magnitude, and therefore require our particular notice.

Morecambe Bay Embankment.—The formation of an embankment of upwards of ten miles in length, across an estuary where the sea has been known to rise 30 feet, and where in gales from the north-west to the south-west, it rolls in with tremendous force, and with a rate of tide during the springs, of more than four knots an hour, may justly be termed a project of a gigantic character, and will, if executed, reflect much credit on the engineer.

The mode in which Mr. Hague would form the embankment is both novel and ingenious. (Vide *Journal*, Vol. I., p. 409).

The mode proposed for forming the embankment across the Dudden is the same as that for Morecambe Bay.

In Mr. Hague's report, (which will be found in the *Journal*, Vol. I. p. 410), he states that the total cost of forming the embankments and railway across Morecambe Bay and the Dudden Sands, would amount to £345,230 3*s.* 4*d.*, and of forming the new channels for the rivers which flow into these estuaries to £88,901 6*s.*, making a gross sum of £434,131 9*s.* 4*d.*

Not being satisfied with this statement, we called for a detailed estimate, which Mr. Hague accordingly prepared for us.

In this document the sum allowed for the embankments across the Bay is stated as £395,453 1*s.* 4*d.*, and for the river channels £71,758 0*s.* 7*d.*, making a general total of £467,211 1*s.* 11*d.*, which exceeds by £33,079 12*s.* 7*d.*, the sum specified in Mr. Hague's first report.

On a careful examination of these documents it appeared to us that a further detail was necessary, and we therefore requested additional information in respect to the alteration of the river channels.

From Mr. Hague's reply, which we received on the 23rd March, we find that he estimates the cost of raising the soil from the proposed river courses at only one-third of a penny per cubic yard; and of raising, depositing, and forming it into the embankments at 2*d.* per cubic yard. Conceiving this allowance to be inadequate to defray the cost of the work, we considered it proper to obtain the best information within our reach on this important item of expense; and, on application, we were supplied by the secretary[*] of the Trinity Board with a statement of the average cost of working the dredging engine used by them in the Thames. These are of the same power as the engines which Mr. Hague proposes to use; and it appears that, independently of the first outlay for the purchase of the vessel and machinery, the average expense of raising the mud from the river and shooting it into the barges, amounts to not less than 3*d.* per ton. Estimating the weight of a cubic yard to be 1 1-5th ton, the cost of removing the soil from the River Thames to the barges only, according to the above statement, amounts to 3 3-5ths of a penny per cubic yard.

We have also been in communication with the engineer[†] under whose direction the improvements in the River Dart have recently been made, and this gentleman has favoured us with a statement, from which it appears that the actual expenditure incurred in that work for dredging and depositing amounted to 4*d.* per ton, or nearly 5*d.* per cubic yard. We therefore feel warranted coming to the conclusion that Mr. Hague's allowance of 2*d.* per cubic yard, for dredging and depositing soil, in the formation of the river courses within his proposed embankment, is much too low, and that the smallest estimate that can be admitted for this work is 3½*d.* per cubic yard.

This increase of 1½*d.* per cubic yard would make the cost of the channels amount to £85,999 1*s.* 1*d.*; a sum which we are convinced would be found barely sufficient for the purpose, the more especially as there are other items in the estimate for the channels inserted at inadequate prices.

It is unnecessary for us, under all the circumstances of this inquiry, to go into any great detail of the result of our examination of the estimates of the embankment; but we must observe that an insufficient allowance has been made for the cost of some of the items, and especially in respect to the mass of stones proposed to be placed under the railway, in the centre of the embankment.

Mr. Hague allows £50,089 17*s.* 6*d.* for this item; but he has so much under-rated the quantity of stones that would be used, that without adding anything to the price which he has allowed for this material, and which we also think too low, we feel bound to add one-fourth to the above stated gross sum, increasing it to £62,612 6*s.* 10½*d.*

We should also observe, that in Mr. Hague's estimate of the embankments, he has not only inserted very low, and, on some occasions, inadequate prices for the proposed works, but he has also given the mere net quantities of materials and labour, allowing nothing for those contingencies which, in all great works, invariably arise. In an operation of the peculiar and difficult character now under consideration, contending, as the engineer would have to do, with the rapid tide we have described as pouring into the bay, contingencies beyond the ordinary proportion would be inevitable, and the least allowance that could prudently be made for them would be 10 per cent.

It is stated by Mr. Hague that the operations of the tide would supply 6,149,379 out of the 10,453,785 of cubic yards of sand and silt required for his embankments, and that when formed as proposed, they will be watertight, without having recourse to the expensive operation of puddling.

We do not believe that these expectations would be realized; but even admitting that this would be the case, the minimum cost of the embankment and channels, according to our opinion, would amount to £493,975 11*s.* 9½*d.*, and, with the addition of 10 per cent, for contingencies, the estimate should not be stated at less than £543,373 2*s.* 11¼*d.*, being £109,241 14*s.* 7½*d.* more than the sum specified in Mr. Hague's original report.

The projectors and promoters of the Morecambe Bay line appear, however, to entertain a confident expectation of effecting their object at a cost which would render the work highly advantageous in a pecuniary point of view, and, at the same time, most beneficial to this part of the country.

A very intelligent gentleman,[*] who is a land-owner at the upper part of the bay, has made several experiments, with various kinds of grain, to test the quality of the soil proposed to be enclosed; and based upon the results he has thus obtained, he gives it as his decided opinion that it will be highly productive.

It is now necessary to say a few words respecting the proposed operations at Whitehaven and Harrington.

Proposed operations at Whitehaven.—We annex two sketches, showing the line selected for the railway through those places. It will be seen, that the intention is to take down houses in Whitehaven to the extent of half a mile in length, and to construct the proposed viaduct on the sites which these buildings occupy. It is true that, for the most part, they are of little value; but, nevertheless, the compensation that would be claimed for them would, in all probability, be considerable; and, should they become the subject of litigation, the amount that would be awarded to the proprietors, and the law expences connected with this part of the work, would be found no inconsiderable items in the cost of the railway.

As we have already stated, it is intended to cross Harrington Harbour by a viaduct.

The crossing of the Harbour at Harrington.—The whole extent of the harbour is only 762 feet in length, and 220 in breadth; and, as it is used as well for a port of refuge as of lading, and there is an insufficiency of space for vessels to anchor and swing in, an artificial beach has been formed at the eastern or upper end, on which they are enabled to bring up.

The proposed viaduct would cut off about a third of the harbour. This would not only be objectionable on account of its diminishing the capacity of the port, but also by its depriving the shipping of the artificial beach to which we have just alluded. The objection to curtailing the size of the harbour will be apparent, when we state that the harbour-master supplied us with a return (verified by the custom-house officer), by which we find that, in the course of the last year, no fewer than 510 vessels used this port, and that, during gales of wind, it was frequently so full that they were in actual contact from side to side. After well considering this part of the subject, we are of opinion, that whatever expense or other inconvenience it might cause, it would be necessary to adopt some other mode of carrying the railway past Harrington than that proposed.

From the table of gradients it will be seen that the gradients of this line are very favourable.

EXAMINATION OF THE INLAND LINES.

Examination of the Line from Penrith to Carlisle.—We shall now describe the two inland lines, commencing with the proposed railway from Penrith to Carlisle, which is common to both projects.

In this line, which is about 17½ miles in length, no engineering difficulty presents itself.

It would pass through or near the following places: Calthwaite, Southwaite, Barrock, Wreay, Brisco, and Upperby, to form a junction with the Newcastle and Carlisle Railway at St. Nicholas.

The greatest embankment in this distance would be about two miles in length, and of an average height of about 16 feet, between Penrith and the Peteril stream.

At Southwaite, a cutting would be necessary of about three quarters of a mile in length, averaging 20 feet in depth, in sand and clay.

Near Wreay, a heavy cutting is proposed, in sand and gravel. Its length is about a mile, and its extreme depth 50 feet, the average being 30.

Examination of the Line of the Lune, from Lancaster to Penrith.—We shall proceed to point out the course of the lines which are proposed to form a junction with the Penrith Railway, and we shall begin with the project of the valley of the Lune, starting from Lancaster.

It is intended that the terminus should be that of the Lancaster and Preston Railway, and that the line should be carried in the direction of Kirkby Lonsdale; a few miles to the westward of Sedbergh; thence by Borrow Bridge and Orton, and through Crosby, Ravensworth, Newby, Melkenthorp, and Clifton, to Penrith.

Between Lancaster and Kirkby Lonsdale the prominent features of this line are, first, the crossing of the River Lune at the Crook, on a bridge of 60 feet in height, and consisting of three arches of 50 feet span; then short cuttings in gravel of 65 feet, and 50 feet in depth; and near Kirkby Lonsdale a cutting of a quarter of a mile in length, and of the extreme depth of 67 feet, in limestone.

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[*] Jacob Herbert, Esq.

[†] Mr. William Kingston.

[*] Mr. James Stockdale, of Carke.

From this spot to nearly opposite to Sedburgh, the only engineering work requiring notice is the crossing of the Lune twice in the short distance of 15 chains.

At Borrow Bridge the Lune would have to be crossed on a bridge of about 48 feet in height, consisting of one arch of 60 feet span; and here an embankment of nearly half a mile in length, and of the mean height of 20 feet, would also be necessary. From hence to Orton the points deserving of remark are the formation at Tebay of an embankment of half a mile in length, and about 35 feet in height; and the crossing of the Lune on a bridge of 54 feet in height, and about 200 feet in length.

From Tebay the line rises at the rate of 1 in 132, for upwards of three miles to Orton Scar, the proposed summit, which is 650 feet above the Lancaster terminus.

In approaching this summit, where a tunnel of about 1 mile and 30 chains would be requisite, there would be a cutting in rock of rather more than a mile and a half in length, and averaging 48 feet in depth; the extreme depth being 84 feet. On the northern side of the tunnel, another cutting in the same material would occur, of about half a mile in length, averaging 36 feet, and of the extreme depth of 75 feet.

These two cuttings, and the tunnel, which are in red sand-stone and limestone, would be the heaviest and most expensive operations on this line.

The extreme height of the hill above the tunnel is shown in Mr. Larmer's section as being 322 feet, and this we have found to be correct, by a survey made under our directions, and to which we shall hereafter more particularly allude.

Between the northern end of the tunnel and Crosby Ravensworth, the railway would keep in the valley, in which Mr. Larmer proposes to cross a mountain stream two or three times; for this purpose bridges would be necessary; but we are of opinion that it would be better to change the course of the stream, and to form a proper embankment for the railway, to keep it clear of the water during floods.

At Crosby Ravensworth a bridge 44 feet high, and at Mauls Meaburn another, 50 feet high, would be necessary, over two streams; an embankment would likewise be required at the latter place. At Morland Bank there would be an embankment of half a mile in length, and of the extreme height of 55 feet.

Between Newby and Melkenthorp a cutting in limestone, of a mile in length, and of the extreme depth of 28 feet, would be requisite. At the last-named place the Leathe would have to be passed, on a bridge of 66 feet in height, with an arch of 50 feet span, approached by considerable embankments.

At Clifton there must be a cutting in sand, of about a quarter of a mile in length, and averaging 30 feet in depth.

Between Clifton and Penrith, the Rivers Lowther and Eamont would have to be crossed on bridges of 52 feet in height, and 200 yards in length.

Examination of the Kendal Line, from Lancaster to Penrith.—It remains for us to describe the Kendal line.

It is proposed that this line should form a junction with the Lancaster and Preston Railway, at about 2 miles 54 chains from the terminus at the former place; that it should pass in a tunnel under the town of Lancaster, and then by a stone bridge across the river Lune, near the ruins of the old bridge.

From this point it would pass the villages of Sline, Bolton, Carnforth, and Warton; and thence crossing the Rivers Betha and Viver and the canal, it would be carried to within about a mile of the town of Kendal.

The line would then be continued by a rather indirect course to the entrance of the valley of Long Sleddale, where it would cross the river Sprint. It is intended that it should be carried to the upper end of this valley, where a tunnel becomes necessary to pass through Gate Scarth. Issuing on the north side of the hill, the railway would open on the valley of Mardale-green, and after passing by another tunnel through Chapel Hill, be continued along the western side of the lake of Hawes Water, surrounded by scenery of the most beautiful and romantic character, as far as the village of Brampton. From hence it would run for several miles nearly parallel to the course of the River Lowther, as far as the village of Askham, where it would skirt the park of Lowther Castle; it would then have to cross the River Eamont, and proceed direct to the proposed southern terminus of the Carlisle and Penrith Railway.

The chief details of this line are as follow:—

The length of the tunnel proposed to be formed under the town of Lancaster is 13 chains; the length of the bridge over the Lune is represented by Mr. Bintley to be 400 feet, and its height 26 feet. Near Hestbank a tunnel of eight chains in length is shown in Mr. Bintley's section, but it is believed that this may be avoided.

No severe work would occur until nearly opposite to Carnforth Lodge, where there would be a cutting of half a mile in length, averaging 20 feet in depth, followed by an embankment of about a mile and a quarter in length, and 20 feet in mean height, having, about mid-way, a bridge over the River Keer.

From hence towards Burton there would be two cuttings through alluvial soil and limestone; the average depth being about 30 feet, and the total length something more than a mile.

Between the towns of Burton and Kendal the rivers Betha and Viver, as well as the Lancaster and Kendal Canal, would have to be crossed on bridges, and a tunnel of 13 chains in length, and nearly half a mile of deep cutting in schistose rock, would be necessary.

From Kendal to the entrance of the proposed summit tunnel, Mr. Bintley's section shows the necessity of the following works; and although an inspection of the country led us to believe that the line might, in some few instances, be improved, we do not think that the alterations we suggested on the spot are of sufficient importance to be adverted to in this report.

There are two rock cuttings of the average depth of 30 feet, and measuring together seven eighths of a mile in length; then there is a viaduct of the extreme height of 125 feet, and 16 chains in length; and in the following order, a tunnel of 11 chains, another of 14½ chains, then a cutting of three quarters of a mile in length, and averaging 48 feet in height; a viaduct 114 feet in extreme height, and 9 chains long, a cutting a quarter of a mile in length, of the average depth of 30 feet; an embankment also of a quarter of a mile in length, and 45 feet in height; again a cutting of the same length, and 38 feet in depth, an embankment half a mile in length, and 40 feet in height, crossing the Sprint on a bridge; and, finally, another embankment of 25 chains in length, and 50 feet in height.

These cuttings are chiefly in schistose rock. The River Sprint, which runs through the valley of Long Sleddale, has a rather tortuous course; and, as it frequently crosses the line of the railway, some difficulties would necessarily arise in diverting the course of this river, as well as of the mountain streams which flow into it.

In connexion with the summit tunnel there is a cutting, the longitudinal section of which is nearly of a triangular form, being three quarters of a mile in length, and 63 feet in extreme depth.

The length of the tunnel is shown on the section prepared by Mr. Bintley as 2 miles and 20 chains, and as being 1200 feet under the summit of the hill through which it would have to be pierced. On issuing from the tunnel, on the north side of the hill, there would be a cutting of rather less than a quarter of a mile in length, and about 40 feet in depth, and then a short tunnel of 20 chains, through Chapel Hill. It is stated by Mr. Bintley, that these cuttings and tunnels would be in rock of the clay slate formation.

The Rev. A. Sedgwick, who has very minutely examined this district, represents it as being composed of green slate and porphyry, which he conceived to have been elevated by the protrusion of mountain granite and syenite.*

Beyond the short tunnel there would be an embankment of about a mile in length, and about 28 feet in height. From hence, passing by Brampton and Hilton, there is nothing of importance to notice until arriving at Askham, where a cutting would be requisite, in rock of the grawacke formation, of 1¼ mile in length, and averaging 25 feet in depth.

Between Askham and Penrith there is no work of consequence, excepting the bridge across the Eamont, which would require to be 85 feet in height, and 200 feet in length.

Operations of an expensive or difficult character on the Kendal Line.—The engineering difficulties, or works of a very expensive character on the Kendal line, are as follows:—

1st. The tunnel under the town of Lancaster.
2nd. The bridge over the Lune.
3rd. The works in the valley of Long Sleddale; and,
4th. The summit tunnel.

The tunnel under the town, although only 13 chains in length, would be expensive, and might give rise to some opposition on the part of the inhabitants.

It is proposed to build the bridge for the railway over the Lune at the point where the old bridge formerly stood, and where the river makes an elbow towards the southern shore. In order to diminish the cost of the work, by avoiding the necessity of using coffer-dams, Mr. Bintley proposes to construct the bridge on the shore, opposite to Lancaster, and afterwards to divert the course of the river, so that it may flow through the arches of the proposed bridge, and he would then fill up the present bed of the river, and form an embankment across it.

The operations in the valley of Long Sleddale would require to be managed with much care and dexterity, for owing to its narrowness, and the space required for the railway embankments, the present courses of the River Sprint, and of its tributary streams, would be much interrupted.

However, all these matters are of but little moment in comparison with the great work of this line, the summit tunnel.

Summit Tunnel on the Kendal Line.—We have before remarked that this tunnel is proposed to be 2¼ miles in length, and to be approached on the south through a cutting of three quarters of a mile in length, and on the north by a tunnel of one quarter of a mile in length, and a cutting of nearly the same extent, making a total length of nearly 3½ miles of very severe work.

Comparison of the Lines.—Having now described, in sufficient detail, the principal features, as far as regards construction, of the three competing lines, we shall proceed to consider their defects and advantages, in order to decide upon their relative merits.

In the two inland lines, which we shall first compare together, the most striking defects are, obviously, their summit tunnels. * *

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* Trans. Geological Society, 2nd Series, vol. 4, p. 67.

Observations on the mechanical properties of the three competing Lines.—*Coast Line.*—Referring now to the mechanical properties of these lines, it appears that the length of railroad to be executed on the coast line, between the terminus of the Preston and Lancaster railway at Lancaster, and the Maryport railway, amounts to 66 miles 42 chains, and that the length of the Maryport and Carlisle Railway, which is now in progress, is 28 miles 3 chains, making the whole distance between Lancaster and Carlisle 94 miles 45 chains; the gradients being of a favourable description.

Lune Line.—By the inland line of the valley of the Lune, Orton, and Penrith, the whole distance between Lancaster and Carlisle is 68 miles 48 chains; but the gradients are less favourable than those of the coast line.

Kendal line.—By the other inland line viâ Kendal, the distance between the termini at Lancaster and Carlisle is only 64 miles 34 chains; but as this line enters Lancaster on a different level from the terminus of the Preston and Lancaster railway, it does not form a junction with that line till it has passed [illegible] miles 54 chains farther on, towards Preston; so that the whole length of new line to be executed on this route will amount to 67 miles 8 chains, the gradients being somewhat less favourable than on the line of the Lune.

In order to make a comparison of the mechanical advantages and disadvantages of these lines, we have reduced several gradients to equivalent horizontal distances.

The principle of this reduction may be briefly stated as follows.

Explanation of the term equivalent horizontal distance.—There is always an increased tractive power required to ascend a plane beyond that which is requisite on a level, and therefore (the engine being the same) a certain amount of additional time is required in the ascent. This additional time would allow the engine to pass over a certain extent of horizontal distance with the same load, and this increase of distance may be taken as a measure of the retarding effect of the ascending plane.

In descending the same plane, the tractive force and time requisite are less than on a horizontal plane, and this effect may therefore be indicated by a horizontal line shorter than the plane; but as there is always more time lost in ascending than is gained in descending any given plane, a loss is sustained on the aggregate, and this whole effect may be expressed by an increased length of line, greater or less according to the steepness of the plane and the amount of the load, and this increased line is what has been denominated the equivalent horizontal distance.*

This mode of reduction has been carefully applied to the several gradients on each of the three lines now under consideration. We find that the locomotive power requisite to work the coast line of 94 miles 54 chains, with a gross load of 50 tons, is equivalent to that which would work a horizontal line of 98 miles 34 chains; while the mean equivalent distance, for the inland line of the valley of the Lune, is 78 miles 1 chain; and for the Kendal line, between Lancaster and Carlisle, 75 miles 9 chains. As far, therefore, as regards the expense of locomotive power, the advantage is much in favour of either of the inland lines, as compared with the coast line, while all the other expenses are still more in their favour, these latter expenses being generally proportional to the actual distance, such as police, stations, water stations, road repairs, government taxes, &c.

In order to ascertain the effect that this increased locomotive expense would have on the general working expenses of the several lines, we have examined with great care and attention the official returns of the principal working railways, separating, as far as possible, the charges for locomotive power from the other charges; and although we have found considerable differences in the proportions, according to the prices of fuel and other circumstances; yet, upon the whole, it appears to be a fair average to assume the locomotive expenses as amounting to one-third (or about 33 per cent.) of the total working expenses of a line of railway of moderate traffic; and since the equivalent distance on the inland lines is about one-sixth greater than the actual distance, the additional locomotive charge due to the gradients will amount to about 1-18th, or six per cent. on the general expenses of the line; or estimating, as is usually done, the total expenses at half the income, to about three per cent. on the latter; which, if borne by the traveller, would have the effect of increasing his fare 4*d.*, on either the Kendal or Lune line, assuming the fare under ordinary circumstances at 2*d.* per mile. At this rate of charge, and making the addition of 4*d.* on the inland lines, the fare for the journey between Lancaster and Carlisle would be—

By the Coast line	15*s.* 9*d.*
By the Lune line	11 7
By the Kendal line........................	10 11

In respect of time; estimating the speed, including stoppages, at 22½ miles per hour on the equivalent distances on the three lines, we find it to amount—

By the Coast line to........................	4h. 22m.
By the Lune line	3 28
By the Kendal line	3 20

It appears therefore, notwithstanding the mechanical disadvantages of the gradients of the inland lines, as compared with those on the coast line, that the expense to the traveller, as well as the time of performing his journey, would be considerably greater on the latter line than on either of the former.

We have next examined the claims of the three lines as regards the amount of population, and present coach and mail traffic.

The amount of population per mile has been found by dividing the total population within 10 miles on each side of the respective lines by the number of miles, employing in each case the census of 1831, and the amount of coach traffic has been determined in the usual way, from returns supplied to us from the stamp office.

We thus find—

	Population per mile.	Passengers per annum.
By the Coast line........................	1,923	8,040
By the Lune line........................	2,240	21,528
By the Kendal line........................	2,460	21,528

To bring these several results more immediately into one point of view, we have collected and arranged them as in the following table:—

Table showing the Relative Properties of the projected Lines between Lancaster and Carlisle.

Data.	Kendal Line.	Lune Line.	Coast Line.
	M. C.	M. C.	M. C.
Length of line already made, or in progress ..	—	—	28 3
Length of new line to be made	67 8	68 48	66 42
Length of line to be worked between Lancaster and Carlisle..............................	64 34*	68 48	94 45
Locomotive power requisite to work each line, expressed in equivalent horizontal distances	75 9	78 1	98 34
Expenses of journey, per passenger, at 2d. per mile of actual distance, including 4d. extra on the inland lines	s. d. 10 11	s. d. 11 7	s. d. 15 9
Time on each line between Lancaster and Carlisle, at 20 miles per hour, of equivalent distance..................................	H. M. 3 20	H. M. 3 28	H. M. 4 22
Population per mile in length, within a distance of ten miles of each line	2,460	2,240	1,923
Average number of passengers licensed to be carried per annum, by mails and stage-coaches, the whole distance	21,528†	21,528†	8,040

It will be clear from an inspection of this table, that it would cost each passenger between Lancaster and Carlisle about 4*s.* more on every journey by the coast route than by either of the inland lines, besides the loss of nearly one hour in time.

For these reasons, as far as regards the communication between England and Scotland, which is the great object of our inquiry, we consider it to be our duty to give the preference to one of the inland lines.

As regards the communication between London and Manchester, viâ Carlisle, with Glasgow, there can be no question, from what has been stated, that the preference ought to be given to one of the inland lines; but it must also be admitted, that the coast line would offer greater facilities for communicating with Belfast and the north of Ireland.

We have, however, to observe, that the harbour now forming at Fleetwood, which, by the Preston and Wyre Railway, will be put in communication with London, and the manufacturing districts of Lancashire, appears to us likely to form a good point of departure for the north of Ireland and west of Scotland.

But the great question for consideration is, whether every passenger between Lancaster and Glasgow shall be compelled to spend 4*s.* or 5*s.* and lose one hour each journey by being taken round by Maryport, or whether the Irish passenger shall incur the same increased expense, and about the same loss of time, by being taken round by Carlisle to Maryport, to embark in the Belfast steamer, supposing him to select this route in preference to that by the Preston and Wyre Railway to the Harbour of Fleetwood. Now, as such steamer can only be supposed to make one or two passages per week, while the trains between Lancaster and Csrlisle would probably run several times per day, it would be exceedingly prejudicial to the general public interest that the whole of the Scotch traffic should be compelled to pass along the coast line. With regard to the statistical claims of the coast line, it appears from returns with which we have been furnished, of the assessed taxes along this line, as well as of the exports and imports of the several harbours, the steam-boat traffic, and population, that these, although considerable between Carlisle and Whitehaven, are not so for the remaining 54 miles, viz., between Whitehaven and Lancaster, so that when divided upon the whole distance, they are generally less per mile than on the inland lines.

Opinion as to the preference which should be given.—From a full and careful consideration of all the bearings of the case, we therefore feel it our duty to reject the coast line, so far as regards its being made a link in the chain of connexion between England and Scotland.

The next question is, the preference which ought to be given to one of the two projected inland lines.

Referring again to our table, it appears that the mechanical superiority, although inconsiderable, is with the Kendal line, its equivalent distance being 75 miles 9 chains, while that of the Lune line is 78 miles 1 chain.

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* See appendix to Barlow's treatise on the strength of Iron, &c., and also part 3, vol. iii, of the Transactions of the Institute of Civil Engineers.

* The Kendal line passes the Lancaster station to a junction with the Preston and Lancaster, 2 miles 54 chains nearer to Preston than Lancaster, making the distance from Carlisle to Lancaster only 64 miles 34 chains.

† Each of these numbers include the whole present mail and stage traffic between Carlisle and Lancaster, viâ Penrith.

The statistical properties are nearly the same on both lines, with the exception that the Lune line would not take in its route the important and thriving town of Kendal. The advantages this town would derive from the near approach of a railway from the north would be considerable, particularly from the facility it would afford for obtaining coal, of which the consumption is there represented to be large; and reciprocally the railway would derive an increase of its revenue by its connexion with this town.

It was evident to us in the course of our inspection of the country, that the engineering difficulties of that part of Mr. Bintley's line which extends from Kendal to Mardale Green, would entitle the Lune line to a preference, and we therefore inquired whether it might not be practicable to connect the two lines together by adopting Mr. Bintley's route from Lancaster to Kendal, and Mr. Larner's from Penrith down to Borrow Bridge, and by finding a practicable line from the last named place to Kendal; but Mr. Larmer stated that such a line would be of too expensive a character to admit of this proposition being entertained. However, since our return to London, and indeed since this report has been drawn up, the provisional committee of the Kendal line have requested us to receive and report upon a survey, recently made by Mr. Larmer, to connect the lines of the Lune and Kent, nearly in the manner above described. Our instructions preclude us from acceding to this request, but we have no hesitation in saying, that if a line has been found which would afford the advantage of a direct railway communication to Kendal, without either materially increasing the cost of construction, or the length of the line between Lancaster and Carlisle, and which would be free from other defects, it might be more beneficial to the public than the Lune line. This, however, is a subject for future consideration, and in the meanweile, keeping in view the general tenor of our instructions, the main feature of which, in the present part of our inquiry, is that we should determine what, under all circumstances, would be the best means of establishing a railway communication between London and the city of Glasgow, having reference, also, to the interests of the manufacturing districts of Lancashire, the western parts of Scotland, and the north of Ireland, we feel bound, after a careful and deliberate review of the advantages and disadvantages of the three competing lines, to state that we give the preference to the line of the valley of the Lune and Penrith over the Kendal line, on account of the greater engineering difficulties on the latter; and that we also give the Lune line a preference over the coast line, in consequence of its shortening the time and diminishing the cost of travelling to the greater proportion of passengers who would require to avail themselves of railway communication north of Lancaster.

We have to remark that the line to which we have thus given a preference, will require a smaller capital than either of the other lines; for the cost of its construction will be less than that of either the Kendal or the coast line; and it must be borne in mind that as respects the last, although its promoters calculate upon a great return for their outlay, by the land to be reclaimed in Morecambe Bay, still the capital for the embankments must be raised in the first instance.

It may not be irrelevant to observe, that if the statement of Mr. Hague, as revised by us in a former part of this report, should be nearly accurate, viz., that the cost of forming water-tight embankments across Morecambe Bay and the Dudden Sands, with the works dependent thereon, would only amount to £543,372 2*s.* 11½*d.*, and if there should appear a probability of the land to be reclaimed realizing so large a sum as £1,196,000, this project might stand on its own merits, apart from any connexion with a railway.

In conclusion, we have only to state that in our inspection of the coast line, we were accompanied throughout the whole distance by Mr. Briscoe, an assistant to Mr. Rastrick, and in our examination of Morecambe Bay by Mr. Hague, the engineer, and by Mr. Yarker, the solicitor, besides other gentlemen interested in this project. Mr. Larmer pointed out the Lune line, and Mr. Bintley the Kendal line, and we were also accompanied by the secretary and several members of the Kendal committee, all of whom evinced every desire to facilitate our inquiry; but it is to be regretted that more time and means had not been at the disposal of the surveyors of the inland lines, to have enabled them to prepare their plans and other drawings in an equally perfect and satisfactory manner with those of the coast line.

We have, &c.,

FREDERIC SMITH, Lieut.-col. R. E.
PETER BARLOW, F. R. S.
HENRY AMSINCK, Lieut. R. N. Sec.

To Robert Gordon, Esq., M. P.

Hull and Selby Railway.—We are glad to be able to state that a deputation of the Directors of this Company went over the line from the passenger station at Hull to the junction with the Leeds and Selby Railway at Selby, on Saturday, May 30. The carriage was drawn by one of the engines made for the Company, by Messrs. Fenton, Murray, and Jackson, of Leeds. The line being laid upwards of one-half of its entire length upon longitudinal bearings of Riga timber, is particularly easy and smooth; the remaining portion of the line is laid upon cross sleepers, and the whole will be completed in a satisfactory manner. As a considerable portion of the second line is finished, and a great number of men are employed upon the remaining part, there is no doubt that both lines will be completed for opening to the public on the 1st July, the time proposed by the Directors. The buildings at the Hull terminus, and also those at the Selby terminus, are nearly finished, as are the various station-houses on the line, and the Directors have in the past week appointed the clerks and other officers of their establishments.—*Hull Observer.*

REPORT ON THE PLANS FOR PREVENTING ACCIDENTS ON BOARD STEAM VESSELS.

IN consequence of the accident of the "Earl Grey" steam boat in 1835, the Trustees of the river Clyde, with a laudable desire to avert similar accidents, very shortly after the disaster issued the following advertisement.

> "THE Parliamentary Trustees on the River Clyde hereby offer a premium of One Hundred Guineas to any person who shall, in the opinion of the Trustees, or of a Committee of their number, within one month of this date, essay or furnish the best practical mode of effectually preventing accidents, from the imperfect construction or use of the steam engine, or gearing of steam vessels, in their navigation upon navigable rivers, and of carrying the same into permanent effect or execution, independent of the control or discretion of the master or crew of the vessel.
>
> The Trustees have also placed at the disposal of a Committee of their number, One Hundred Pounds, to be distributed among such scientific or other persons as may be unsuccessful competitors for the above premium, but who may, nevertheless, suggest such improvements upon the plan of the successful competitors, as, in the opinion of the Committee, may be beneficially adopted or ingrafted upon the said plan."

In compliance with this advertisement there were no less than 65 designs of apparatus and essays sent in. For the purpose of guiding the judgment of the Committee, they determined upon referring the whole to parties fully competent to investigate the merits of each apparatus and essay, and selected the following gentlemen: Mr. Robert Napier, Mr. James Smith, and Mr. D. Mackain, who undertook the task referred to them.

In consequence of the advertisement not limiting the premium to the actual inventor, numerous schemes were sent in which were the inventions of others, and many in daily use in all parts of the world. For the purpose of assisting the referees in their examinations, they divided the several designs and essays into classes, and again subdivided the classes into sections, and after a careful examination the referees sent in their report to the Committee, accompanied with drawings of the apparatus submitted to them. As this report is of considerable length, it is not our intention to give the whole, but shall content ourselves by giving the most material parts of it, accompanied with engravings of the apparatus for which the premiums were allotted.

REPORT.

To the Trustees of the River Clyde, Glasgow, by Robert Napier, Esq., of Glasgow, James Smith, Esq., of Deanstone, and D. Mackain, Esq., of Glasgow.

In compliance with the request conveyed to us severally by Mr. Turner, we have carefully considered the various plans, models and essays, lodged in the Council Chambers, numbered from 1 to 65.

As the terms of the advertisement neither restrict the competitors to the production of plans of their own invention, nor preclude from competition any apparatus already in use, it involves the possibility of the Trustees awarding the premium to one person, for the invention of another; or to the exhibitor of apparatus, which, though in general use, may still be considered the best adapted to attain the end in view.

Though we mention this to show that, unintentionally, private wrong might be done, or that a reward might be paid for an exhibition of that with which every maker of steam engines is acquainted, yet the open nature of the competition may have had the effect of obtaining, and we doubt not it was the object of the Trustees to obtain, a general view of the opinions entertained by persons whose attention has been directed to the important subject of preventing dangerous accidents on board of steam vessels.

The competitors differ in opinion as to the causes by which explosion is produced, and in consequence, the apparatus they submit vary in their construction and proposed use, according to the idea which each entertains on this subject.

A number of the plans very closely resemble each other, differing only in unimportant details—this we consider to be the natural result of so many persons applying themselves to the attainment of one object. It is also remarkable, that a great number have adopted the common safety-valve, as the principal part of their several designs; which may be regarded as a tacit acknowledgment of its general efficiency and extreme simplicity.

From these causes we have found it convenient, in preparing our Report, to divide the plans into classes, according to the causes of explosion which they are designed to modify or prevent, and to form these classes into sections, according to the means by which these objects are expected to be attained.

FIRST CLASS.

The first class contains the designs submitted by the competitors who are of opinion, that explosion proceeds from a gradual accumulation of steam in the boiler, increasing in elastic force by the continued action of fire in the furnaces, until it exceeds the strength of the boiler.

This class is divided into eight sections.

First Section.—The first section embraces those designs by which the competitors propose to discharge a quantity of water into the furnace, or into the flues leading from them, whenever the force of the steam is sufficient to raise the water from the boiler to a certain height in a pipe, so that thereby the intensity of the fire may be diminished.

Second Section.—The principle on which the designs in this section are constructed, is, that when the pressure of the steam is sufficient to raise water from the boiler to a certain height, it rises round a hollow vessel or float, suspended at that height from one end of a lever, the other end being connected with a safety-valve of the common form. In some of the plans, the hollow vessel or float is designed to act as the load on the safety-valve, so that, to whatever extent it may be immersed in the water, so raised by the strength of the steam, to that extent is the safety-valve lightened of its load. In others, the weight of water displaced by the float, is a force, in addition to the steam, to raise a valve loaded in the ordinary way.

Third Section.—This section embraces the greatest number of plans, which contain, in general, the common safety-valve enclosed in a case, so as to prevent all access to it. The design of some of the plans is, however, worthy of attention, from their ingenious complexity.

Fourth Section.—These designs have the common safety-valve cased in, to prevent it from being overloaded, but have attachments to the valve, by which it can be opened by the engine-man whenever he finds it necessary to permit the steam to escape.

Fifth Section.—The distinguishing feature of the plans in this section, is the introduction of a piston in connexion with the safety-valve, with the design that the gradual increase in the force of the steam shall, by acting on the under side of the piston, become a proportionally increasing power to open the safety-valve.

Sixth Section.—The arrangement of the apparatus in this division is designed with the view of loading the safety-valve when the engine is at work, and of taking off the load when it is at rest.

Seventh Section.—In this section the exhibitors propose to substitute mercury for the loaded valve, which is usually employed to confine the steam until it has acquired a certain amount of force.

Eighth Section.—The competitors included in this section propose a connexion to be made between the throttle and safety-valves, by which, when the speed of the engine is required to be reduced, the safety-valve is opened, and the steam allowed to escape.

SECOND CLASS.

The second class of competitors are those who are of opinion that the explosion of boilers is the effect of the instantaneous production of steam, on the evolution and ignition of inflammable gases in the boiler, in consequence of a deficiency of water; by which the flues (or passages through the boilers for the flame from the furnaces) being uncovered, they become red hot, and on water being brought in contact with them, explosion is produced.

This class is divided into two sections.

First Section.—The first section proposes self-acting apparatus for feeding the boilers while the engine is in operation, so as to prevent the water from falling below a certain level.

Second Section.—The second section proposes means of giving information when the water shall have fallen below a certain point in the boiler, by means of a pipe open at both ends and approaching to within a short distance from the flues, so that, when the water shall have been sunk below this pipe, the steam will be allowed to escape.

THIRD CLASS.

The third class are those competitors who consider explosions to be the result of weakness in the boiler, and propose that they shall be frequently proved.

This class might be divided into two sections, viz., those who recommend that periodical attempts be made to explode the boilers with a great pressure of steam, and those who suggest that they shall be frequently proved by a forcing pump; but it is unnecessary to make this distinction.

We shall close this summary by stating that there are several ingenious designs which cannot be classed with any of those mentioned, nor with each other; and, consequently, for an explanation of the principles of their construction and intended mode of operating, it would be necessary to transcribe the several essays in which they are contained; but this we consider unnecessary, from their being nothing of sufficient merit in them to recommend them to the notice of the Trustees. It will be remarked that, almost all the competitors propose their several designs to be adopted only as additions to the existing means of preventing explosion; that they almost unanimously recommended the continued use of the existing safety-valve; that several recommend the frequent proof of boilers: while a few only propose the appointment of inspectors.

In recommending to your favourable consideration some of the designs, we beg to lay before you the circumstances which guided our selection.

The theory advanced in the Essay No. 1, of explosions proceeding from the formation of gas in the boiler, by the flues becoming red-hot, thereby decomposing the water, and then inflaming these gases, has been, in our opinion, most conclusively set aside by the eminent philosopher, Mons. Arago, in a memoir on the subject of the present report. "Some persons," he writes, "struck with the prodigious and instantaneous effects which often result from the explosion of boilers, are persuaded that steam alone is incapable of producing them, and they call to their aid some gases susceptible of explosion." On this he remarks, "Hydrogen alone, or mixed with vapour, cannot explode—a mixture in the suitable proportions of oxygen and hydrogen is susceptible of explosion; but how are these gases to be collected in the boiler? Hydrogen is the product of the oxidation of metal—from whence, therefore, proceeds the oxygen? Can it be from the air contained in the feed water? It is warm, which prevents it from containing much air. I shall add, in fine, that the oxygen of the air would combine itself much more readily with the incandescent sides of the boiler, than with hydrogen; and that the product of the decomposition of water would be—not hydrogen and oxygen, but hydrogen and azote,"—a non-explosion mixture. And further, in a Report by the Committee of the Franklin Institute, on the explosions of steam boilers, made at the request of the Treasury department of the United States, they state, as the result of direct experiment, that the gas obtained by injecting water into a red-hot boiler, was a "non-supporter of combustion, and non-combustible."

The other theory advanced by the Essayists Nos. 1, 4, 7, 8, 9, and 20, is, that if the flues become red hot, and water be poured into the boiler, a volume of steam, of dangerous elasticity, is instantaneously formed, to which the safety-valves cannot give vent with sufficient rapidity, and, in consequence, the boiler explodes. In regard to this supposed cause of explosion,—the American Commissioners succeeded in exploding an experimental boiler, by injecting water into it while not only the flues, but the top, bottom, and sides, were assiduously kept red hot. This was done to ascertain the greatest effect that could be produced by steam generated under such circumstances. Their other experiments prove that water does not evaporate so rapidly when brought in contact with red-hot iron, as when the iron has been cooled down to a much lower temperature, and at this reduced temperature iron does not contain any considerable quantity of heat. In all experiments made by them and others, *time* has been a necessary constituent in the circumstances which permit a certain volume of water to be evaporated, and *confinement* to give it force; and the opening of a safety-valve has always been found to diminish the pressure, and lower the temperature of the steam. We are inclined, under a peculiar and merely possible combination of circumstances, to view this as a cause of danger; but we have not been able to discover any authentic instances in which explosion has been clearly traced to it. The general practical result of the flues being allowed to get red hot, is, that the plates composing them crack on admission of water, and from the copious discharge of boiling water and steam which ensues, many serious accidents have happened to the engine-men and fire-men, through whose negligence they have been occasioned.

Notwithstanding of the above theories advanced by the competitors, and also of several others promulgated by persons of high standing in the scientific world, we cannot, after a careful comparison between their reasoning and our own experience, arrive at any other conclusion than—that the explosions of steam boilers proceed from a gradual accumulation of steam, which, being deprived of sufficient means of escape, is, by the continued action of the fire in the furnaces, raised to a dangerous, and often destructive degree of density; and we conceive that all danger can be avoided by the regular action of the common safety-valve, if properly constructed and made of *sufficient capacity*. It sometimes happens that these valves, from neglect, become fixed; and we are of opinion, that the apparatus designed by the Essayists Nos. 2 and 41, which are drawn as figures 1 and 2,* are well calculated to apply a force, in addition to the strength of the steam, to overcome this adherence; and they have the advantage of being so designed, that after the overplus of steam shall have escaped, the safety-valve is allowed to resume its useful position.

We have remarked, that the greater number of explosions of steam boilers have occurred at the instant of starting the engine. Without taking on ourselves to assign any reason for this, or our being able to trace the immediate circumstance which precedes, and may have caused the explosion, we are of opinion, that the risk of accident may be lessened by the weight on the safety-valve being diminished until the engine is in motion, and the steam flowing away by a regular current. We are not satisfied with the efficiency of the various plans which are designed to attain this object; but we recommend to your notice, for its novelty, the design in Essay No. 18.

We conceive it to be of importance, that the safety-valve should be secured from improper interference; but, at the same time, that it should be so connected with the ordinary occupation of the engine-man, as to be put into almost hourly use. This must lessen, if not entirely prevent, the chance of it becoming fixed to its seat. Of the designs submitted to us, we consider that the plans in the Essays 4, 38, 55, and 56, are best adapted for this object, though they have been found liable to the inconvenience of becoming fixed at the joints which are inside of the boiler. Figures 33, 36, 38, and 40, are, we believe, in use in several steam vessels on the Thames, the Clyde, and the Mersey, and No. 36 has been seen on board the French Government steamer, "Le Meteore."

A number of the competitors recommend that the safety-valve should be locked up, to prevent all access to it by the engine-man; but in this recommendation we do not concur,—for, if those in charge of the engine be prevented from ascertaining the condition of the safety-valve, no reliance can be placed on it as a mean of preventing accident.

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* The figures 1 and 2 will be found in another part of the Journal.—ED. C. and E. Journal.

We also feel ourselves opposed to the majority of the competitors as regards a feeling which they evince against engine-men as a body. In any large class of society, there are always to be found individuals, whose improper conduct no laws can restrain; and we are inclined to think that the number of engine-men who recklessly endanger their own lives and the property under their charge, are nearly in the same proportion to the mass of engine-men, as felons are to the mass of society, notwithstanding of the watchful superintendence of the immense army of the law.

In a matter of such importance to the public, and to the proprietors of steam engines, we cannot avoid expressing our regret, that in the cases of explosion which have occurred, there are no scientific reports of the appearance and state of the engines, valves, or boilers. If a regulation were adopted by the local authorities, requiring intimation of every case of accident, and obtaining thereafter, before any alteration had been made on the damaged boiler, machinery, or buildings, a detailed report of their situation and appearance, we are of opinion that more certainty would soon be given to the conjectural causes which produce such accidents; and that, in consequence, in the construction or management of steam engines, means would be adopted which would lessen the chance of their recurrence.

In regard to the appointment of inspectors, which some of the competitors recommend, we beg to express our doubts as to the expediency of this measure. They must either be armed with discretionary powers, to admit or reject any alteration in construction or management of the machinery—in which case the immense amount of capital invested in steam vessels at each port must be subjected to the individual caprice of the inspector—or it will be necessary, in order to furnish them with precise instructions, that the Act of Parliament by which they are appointed, shall regulate what are and what are not infallible securities against accidents of every kind.

When we compare the almost innumerable multitude of persons who have annually availed themselves of steam conveyance at sea and on railways, for many years past, with the number of accidents that have occurred, it is gratifying to us to consider, that, with our attention so closely turned to the subject as it has been for some time, we not only cannot trace any cause of alarm, but are able to express our conviction, that it is the safest means of transport that now exists.

In conclusion, we beg to report our opinion, that a combination of the plans we have recommended to your notice might be advantageous, provided the attachments by which they are connected with the safety-valve be such, as that by no derangement of the new apparatus, can the former be prevented from acting. But we can view them only in the light of experiments, which will require some time of watchful superintendence, to ascertain their mode of operating under various circumstances, and to detect and remedy errors in their construction.

Extract from Additional Report.

In compliance with this instruction, we have no hesitation in recommending to you the plans marked by the Committee Nos. 2 and 41, lodged by Mr. James B. Neilson and Mr. George Mills, both of Glasgow. It will be evident on inspection, that they are identical in design, and that the difference in their proposed construction is quite immaterial. (See Figs. 1 and 2.)

For the reasons stated in our General Report, we conceive them to be the best of the designs submitted to the Trustees for preventing explosion.

You are farther pleased to request, that we should name "the three persons who have brought forward, in your opinion, the three *next* best plans, so as to enable the Trustees to consider whether any portion of the additional sum of One Hundred Pounds, allocated by the trustees, is, in the circumstances, fairly and justly due to any of the competitors who may be unsuccessful in obtaining the principal premium of One Hundred Pounds."

From the extreme similarity in design and execution of the plans which appear to us entitle to rank in the second class, we are unable to reduce their number to less than four, viz., those numbered by the Committee 4, 38, 55, and 56, which were severally lodged—the three first by Messrs. Allan Clarke and David Thompson of Glasgow, and Mr. John Baird of Shotts; and the last, the joint production of Messrs. William Neilson and William Muir of Glasgow.

Mr. David Thompson states that his design has been in use at Messrs. Boulton & Watt's Engine Factory at Soho; and, as stated in the General Report, the others are precisely similar to apparatus in common use in vessels on the Thames, the Clyde, and the Mersey; and, through the politeness of the commander, there was exhibited to one of the reporters, on board of the French Government steam vessel, "Le Meteore," arrangements for working the safety-valves, which were similar in design and mode of operation to the plans in Nos. 38, 55, and 56.

As we are of opinion that the premiums offered by the Clyde Trustees were for apparatus presenting some novelty of construction, and possessing means of security beyond that which the existing safety-valves and connexions have been supposed to afford, we do not, under this impression, consider these gentlemen *entitled* to participation in the second premium; but leave this to the decision of the Trustees.

We have no other remarks to offer to your consideration on the residue of the plans.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL SOCIETY.

March 12.—The Marquis of Northampton, President, in the Chair.

The following papers were read:—

"*On certain variations of the mean height of the Barometer, mean Temperature, and depth of Rain, connected with the Lunar Phases, in the cycle of years from* 1815 *to* 1823." By Luke Howard, Esq.

The table given in this paper contains the results of calculations relating to the objects specified in the title, cast into periods of six, seven, or eight days, so as to bring the day of the lunar phase belonging to it in the middle of the time. The observations were all made in the neighbourhood of London. It appears from them that in the period of the last quarter of the moon the barometer is highest, the temperature a little above the mean, and the depth of rain the smallest. In the period of the new moon, both the barometer and temperature are considerably depressed, and the rain increased in quantity. The influence of the first quarter shows itself by the further depression of the barometer; but the temperature rises almost to the point from which it had fallen, and the rain still increases, but not in an equal ratio. Lastly, the full moon again reduces the temperature, while the barometer attains its maximum mean height, and the quantity of rain is the greatest. Thus it appears, that during this lunar cycle, the approach of the last quarter is the signal for the clearing up of the air, and the return of sunshine.

"*On the theory of the Dark Bands formed in the Solar Spectrum, from partial interception by transparent plates.*" By the Rev. Baden Powell.

This paper contains the mathematical investigation of the phenomena of peculiar dark bands crossing the prismatic spectrum, when half the pupil of the eye, looking through the prism, is covered by a thin plate of any transparent substance, the edge being turned from the violet towards the red end of the spectrum; and which were first noticed by Mr. Fox Talbot, and were ascribed by Sir David Brewster to a new property of light, consisting of a peculiar kind of polarity. The author shows, that on the undulatory theory, in all cases, a difference of retardation between the two halves of each primary pencil throughout the spectrum, may give bands within certain limits; and that it affords a complete explanation of the phenomena in question.

March 19.—The Marquis of Northampton, President, in the Chair.

The following paper was read:—

"*Contributions to Terrestrial Magnetism.*" By Major E. Sabine.

An increased activity has recently been given to researches in terrestrial magnetism, with the definite object of obtaining correct maps of the magnetic phenomena, corresponding to the present epoch, over the whole surface of the globe. To aid these researches, and to facilitate the comparison of the general theory of M. Gauss with the facts of observation, maps have been constructed of the magnetical lines, both as computed by the theory, and as derived from observations already obtained. The theoretical and actual lines of the declination and intensity have thus been represented in maps recently published in Germany and England, as have also the lines of the inclination computed by theory; but the corresponding map or the latter element derived from observations is yet wanting. The object of the present communication is to supply this desideratum, as far as regards the portion of the globe contained between the parallels of 55° N. and 55° S., and the meridians of 20° E. and 80° W.; comprising the Atlantic ocean and the adjacent coasts of the continents on either side. The observations chiefly employed for this purpose are two series *made at sea*; one by Mr. Dunlop, of the Paramatta observatory, in a voyage from England to New South Wales, in 1831; the other by Lieut. Sulivan, of the Royal Navy, in a voyage from England to the Falkland Islands and back, in 1838 and 1839. The observation of the magnetic dip at sea, which was commonly practised by the distinguished navigators of the last century, was unfortunately not resumed when the interest in such researches was revived on the restoration of peace; but it is by such observations only that the lines of inclination can be independently traced over those large portions of the globe which are covered by the ocean. The difficulties which attend the observation, occasioned by the motion and the iron of the ship, require the adoption of several precautions, which it is particularly desirable at this time to make generally known. The series of Messrs. Dunlop and Sulivan are discussed in this view; and the value of results obtained under circumstances of due precaution is pointed out by their success. The position of the lines on the land portion of the map is derived from 120 determinations in various parts of Europe, Africa, and America, between the years 1834 and 1839, of which about the half are now first communicated. The series of Messrs. Dunlop and Sulivan contain also observations of the magnetic intensity made at sea; Mr. Dunlop's by the method of horizontal vibrations, and Lieut. Sulivan's by the instrument and method devised by Mr. Fox. The degree of precision which may be obtained by experiments thus conducted, is shown by the comparison of these observations with each other, and with the isodynamic lines previously derived from observations made on land. The first section of this paper concludes with discussions on the relative positions of the lines of least intensity and of no dip, and of the secular change which the latter line has undergone in the ten years preceding 1837. In the second section, the observations of Mr. Dunlop are combined with recent observations on the coasts of Australia, by

Captains Fitz Roy, Bethune, and Wickham, of the Royal Navy, to furnish a first approximation to the position and direction of the isodynamic lines over that portion of the Indian ocean which is comprised between the meridian of the Cape of Good Hope and New South Wales.

March 26.—The Marquis of Northampton, President, in the Chair.

This evening was occupied by the reading of a paper, entitled "*Researches in Electricity, 17th series: on the source of power in the Voltaic Pile.*" By Michael Faraday, Esq.

May 14.—Major Sabine, R.A., V.P., in the chair.

The following paper was read:—

Experimental Researches into the Strength of Pillars of Cast Iron, and other Materials. By Eaton Hodgkinson, Esq.

The author finds that in all long pillars of the same dimensions, the resistance to crushing by flexure is about three times greater when the ends of the pillars are flat, than when they are rounded. A long uniform cast-iron pillar, with its ends firmly fixed, whether by means of discs or otherwise, has the same power to resist breaking as a pillar of the same diameter, and half the length, with the ends rounded, or turned so that the force would pass through the axis. The strength of a pillar with one end round and the other flat, is the arithmetical mean between that of a pillar of the same dimensions with both ends round, and one with both ends flat. Some additional strength is given to a pillar by enlarging its diameter in the middle part. The author next investigated the strength of long cast-iron pillars with relation to their diameter and length. He concludes that the index of the power of the diameter, to which the strength is proportional, is 3·736. He then proceeds to determine, by a comparison of experimental results, the inverse power of the length to which the strength of the pillar is proportional. The highest value of this power is 1·914, the lowest, 1·537, the mean of all the comparisons, 1·7117. He thus deduces, first, approximate empirical formulæ for the breaking weight of solid pillars, and then proceeds to deduce more correct methods of determining their strength. Experiments on hollow pillars of cast-iron are then described, and formulæ representing the strength of such pillars are deduced from these experiments. After giving some results of experiments still in progress for determining the power of cast-iron pillars to resist long-continued pressure, the author proceeds to determine from his experiments the strength of pillars of wrought-iron and timber, as dependent on their dimensions. The conclusion for wrought iron is, that the strength varies inversely as the square of the pillar's length, and directly as the power 3·75 of its diameter, the latter being nearly identical with the result obtained for cast-iron; for timber, the strength varies nearly as the fourth power of the side of the square forming the section of the pillar. Experiments for determining the relation of the strength to the length in pillars of timber, were not instituted, as, from the great flexure of the material, it was considered that no very satisfactory conclusions on this point could be derived experimentally. In conclusion, the author gives the relative strengths of long pillars of cast-iron, wrought-iron, steel, and timber.

INSTITUTION OF CIVIL ENGINEERS.

Address of the President.

General Meeting, *February* 4, 1840.

This being our first Meeting since my re-election as your President, allow me to thank you for the honour conferred upon me, and to congratulate you on the choice you have made of the other Members of Council, and Officers, who will I am sure be desirous of justifying the good opinion you have formed of them, by as frequent an attendance at the Meetings and attention to the business of the Institution, as their avocations will permit. This will indeed be but a proper return for the proof of your confidence in us, and I trust that the list of attendances, if again called for at the end of the season, will prove my anticipations to have been correct; for notwithstanding the truth of the old saying, that "where there is a will, there is a way," it must sometimes happen, that the attendance of some of us becomes impossible, from absence at too great distance or other cogent cause; yet I hope I may answer for my colleagues as for myself, that it is our determination to show that we have the "*will.*" But, gentlemen, be it remembered on your part also, that there is a reciprocal duty to perform—that of attendance at our Meetings, to give them the importance which the Council Table being full will not give, if the seats around the room are not respectably occupied; and that blame may not attach where praise is due, the Council (following the precedent set them) have desired a list to be made and tabulated of the attendance at the Meetings of each Member, Graduate, and Associate.

I trust, however, that there will be presented to your attention during the session so much new and interesting matter as will rather ensure your attendance as a personal gratification than as a bare discharge of a duty; unless this should be the case, mine would be an ungracious task to require your constant attendance, but if we succeed in exciting your attention, you will then come unasked. This good can only be attained by numerous and useful communications, which are valuable in themselves and give rise to instructive discussions. The Council therefore require plans and papers from you with the view of ensuring your personal attendance; and I wish to enforce this especially upon the country Members, from whom we receive very few communications. Looking at the extent and rapid progression of public works in this country at present, the new facts that are constantly being developed, the number and influence of the Members of our Institution, there ought not to be any dearth of important and interesting communications. That we have had many such, and that the number of them is increasing, I admit, but still they ought to be much more numerous. My remarks at the last Meeting referred more particularly to Graduates and Associates as defaulters on this head, but I must include the *Members*, not only for what they could themselves do, but more for the exercise of the influence they possess over Graduates in directing their attention to particular objects or works on which they might furnish communications. Half the work is done "when the subject is *fixed* on"—I say this from experience, as would be proved by reference to the communications that have been made through my suggestions at works which I have visited, or by individuals over whom I may be supposed to have some influence. If gentlemen would bear in mind the wants of the Institution whenever they visit any public work, they would rarely leave it without having reaped some knowledge that would be worth communicating, and they may be assured that their labours would be duly appreciated.

I named at the last Meeting the subject of the Library—I stated that which many gentlemen were not aware of, the understanding amongst ourselves, that each Member of the Council should contribute annually some Book, Picture, Drawing, or other present for the Library—I stated also that the Secretary was preparing a list of such books as it is desirable we should possess. This list will be printed and circulated, and I wish the Institution to understand that the Council do not desire to monopolize the right of presenting books but trust that their example will be followed by every one belonging to the Institution. We have space now for a good Library, and for an Institution like ours nothing can be of greater importance. It is especially necessary that our Library should contain as many good books of reference as possible, and I beg to suggest to Members possessing such books, that in presenting ing them to the Institution they do not deprive themselves of the advantage of them, but will have the satisfaction of permitting others to participate with them.

The increasing business of the Institution appearing to the Council to require now the whole and undivided time and attention of one properly qualified gentlemen as Secretary, they thought it their duty to make this a condition previous to appointment; I am glad to say Mr. Manby has accepted the office on these conditions. Mr. Webster, with whose abilities and science we are all well acquainted, has been elected Honorary Secretary, and the more of his time he can give us, the more, I am sure, we shall all feel obliged.

The question of qualification for Honorary Members has already engaged the attention of the new Council, and we may think it right shortly to bring the subject before the Institution. As the Bye Laws now stand, the necessary qualification for a candidate for election as an Honorary Member is, that "he be eminent for *science* and *experience* in pursuits connected with the profession of a Civil Engineer, but not engaged in the practice of that profession in Great Britain or Ireland." Now this distinction is so very circumscribed, that few men can be found who come strictly within its limits, whether we refer to the present list of Honorary Members, or even to the most distinguished individuals in this country who hold the highest places in science or scientific institutions, such as the President of the Royal Society—the Marquis of Northampton,—the Chancellor of the University of London, Lord Burlington. (I cite these two noblemen, whose love of and devotion to science, and whose eminence in certain departments of it, has entitled them to the high places they fill, as persons whom it might be very desirable to connect with the Institution, should such be their wish, but neither of whom can, so far as I know, be strictly said to be "eminent for *science* and *experience* in pursuits connected with the profession of a Civil Engineer.") If it be thought desirable to extend the terms of qualification, the definition may be altered to include individuals distinguished for their patronage and promotion of the studies and works of Civil Engineering, or a class of Patrons might be formed of such men. The Council will give this matter their best consideration, and will, I am sure, in any recommendation they may make, be guided by their desire only to extend the reputation and importance of the Institution.

My old and valued friend, Mr. Turner, of Rook's Nest, Surrey (formerly the friend and partner of Huddart), having presented me with an excellent portrait of that eminent philosopher and mechanic, I have thought that I could not do better than offer it to the Institution, having previously had Mr. Turner's entire approval of my so doing. Those who have seen Huddart's Rope Machinery, which was I believe as much the creation of his own brain as ever machine was of any man's, will not dispute my claiming for him the first rank for eminence in Mechanics: as a Navigator and Hydrographer, he was inferior to none: I had the pleasure of knowing him, and have always thought, that if the Mechanical Philosophers and Engineers of our days were to be ranked in pairs, Huddart was the man to be placed by the side of Watt. I am glad therefore to be the instrument of putting the Institution in possession of the portrait of Huddart, by Wildman, after Hoppner; but this is not unmixed with a feeling of jealousy, arising from our Member Mr. Burges having discovered that Mr. Whitbread had, at his seat in Bedfordshire, a portrait of *Smeaton* (a soul-stirring name to Engineers), by Gainsborough; he has, through Mr. Whitbread's kindness and by the aid of Mr. Turner, placed the picture in the hands of Mr. Wildman, the talented painter of Huddart's portrait, and I can answer for Mr. Burges's kind intentions towards the Institution in the trouble he has so taken.

I have only farther to add, that the Council have come to the resolution of devoting the rooms on the ground floor to the use of the Members of the Institution, and have directed the periodical publications to be placed there. We hope this arrangement will be found generally convenient and agreeable, and we think it will be particularly so to our junior branches and Members from the country, as they may there enjoy all the advantages of a club, with the additional one of being surrounded by their friends.

We trust our Funds will always admit of this arrangement being gratuitous, as well as suffer us hereafter to add to it other means of attraction.

In another point of view it may be found useful, as a central point where gentlemen may make known their being at liberty to accept engagements, and the Engineer may find the assistance he is in need of.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

June 1.—Mr. Kay, V.P., in the Chair.

At the ordinary meeting of this society, several very valuable donations were announced, amongst which a volume of Inigo Jones's designs for the Whitehall Palace, being the original drawings by Flitcroft, for Kent's publication. The council have been for some time engaged in forming a collection of all matters relating to Jones and his works, and this present was therefore a most valuable boon. A long conversation was held on the means of constructing flues, so as to render the employment of climbing boys unnecessary, and a strong desire was shown on the part of the meeting to aid the efforts now being made by the society established for the purpose. Mr. Fowler took occasion to mention to the meeting that the *Société Libre des Beaux Arts*, of Paris, had recently awarded to Mr. G. Godwin, jun., a silver medal, in testimony of their approbation of his published works, and commented upon the liberal feeling the society had thus evinced. A similar compliment was paid to Mr. Donaldson, on the publication of his work on doorways.

A paper was read "*On the Section of the London Bed of Clay.*" By Charles Parker, Fellow.

The principal subject of this paper was a description of the strata passed through in boring two wells in the village of East Acton, which we cannot follow without reference to the diagrams and tables by which it was accompanied. The result was, a further confirmation of the established geological fact, that a stratum of sand extends under the clay, and bears upon a chalk basin containing an immense quantity of pure water, and a further disproval of a commonly received opinion, that when two wells are formed in immediate vicinity, of unequal depths, the water passes from the shallower to the deeper. The two wells in this instance were 300 yards apart. In one, the water was found at the depth of 333 feet, in the other, the spring extended to the depth of 403 feet. In both, the water rose to within 18 feet of the surface, and then gradually subsided to 23 feet.

A section was also given of the strata in the vicinity of Shadwell, and some particulars of a well bored to the depth of 411 feet in the Temple, which emitted an odour so disagreeable as to render the water useless. This odour (having been satisfactorily proved not to proceed from any contact with drains) was supposed to arise from the disengagement of sulphuretted hydrogen. After three months had been expended in trying, without any benefit, the suggestions of several eminent chemists for obviating this inconvenience, the well was abandoned as a failure; but another trial of the water being accidentally made a year afterwards, it was then found to be free from smell, and of a remarkably good quality. A comparison of the chemical analyses made at the different periods, failed to explain in any way the cause of this alteration. The paper concluded with some observations on the employment of iron cylinders in well sinking, and a comparison with a similar mode of proceeding by the ancients with cylinders of baked clay, illustrated by sections of a well at Silinunte, and another at Girgenti.

Mr. Godwin read some observations on the modern state of painting on glass. This paper will be found in another part of the Journal.

June 15.—Mr. Moore in the Chair.

A paper "*On Original Composition in Architecture, illustrated by the works of Sir John Vanbrugh,*" was read by James Thomson, Fellow. (This paper we shall give in full next month.)

Mr. Donaldson read "*A Memoir of the Life of Thomas Archer.*"

Thomas Archer, an English architect, who flourished during the early part of the eighteenth century. He was a pupil of Sir John Vanbrugh, who, being appointed surveyor-general for the new churches in London, which were to be built by the grant of Queen Anne, gave several of them to his pupils. The new church of St. John the Evangelist, in Westminster, fell to the lot of Archer, and was built in 1728. The plan consists of an oblong with rounded corners, having at the east and west ends deep recesses for the altar and vestry, and on the north and south sides, bold projecting enclosed porticoes, flanked on each side by a tower, making four in all, and which now have staircases, to afford access to the modern galleries. At first the interior was enriched by columns, and there were no galleries: so that the inside must have originally been extremely effective. In 1741, the interior and roof were consumed by fire, which left only the walls and columns standing. The church was then rebuilt, the columns being omitted; in 1758 galleries were added, and subsequently lengthened in 1826 by Mr. Inwood, architect. When this fine building was first completed, justice was not done to the originality and powers of the architect; and Horace Walpole, with some other critics of the day, unable to appreciate its beauties, reprobated its cumbrous aspect, and its four towers.

The outside consists of a bold Doric order, well proportioned and elegantly profiled; the columns are about three feet four inches in diameter, and stand upon a lofty pedestal or podium, eight feet high. The north and south porticos are hexastyle, each consisting of four outer pilasters and two central columns; the three centre intercolumniations being recessed, and the outer interpilastrations being solid, these latter serve as bases to the towers, which rise at each end of the tympana. The entablature is surmounted by a ballustrade, except over the porticos, where there are pediments broken through in the centre, for the width of three intercolumniations, to admit a kind of fantastic pedimental group, with a perforated niche. The four towers have square bases to the height of about eight feet above the springing of the pediments, and then assume a circular plan. At the angles there are isolated columns with circular pedestals and circular entablatures, projecting from the main body of the towers. Above the entablature there is a gradually receding roof of concave profile, surmounted by a pine apple. The east and west ends of the roof are enriched by grouped gables, flanked by large enriched scrolls or trusses in the Roman fashion.

The whole composition is impressive, and its boldness loses nothing by the graceful playfulness of the outline. There are some inaccuracies of detail, which a little more study of purer models might have corrected; but the whole is well worthy a distinguished place among the striking productions of the Vanbrugh school. The exterior being entirely faced with stone, its solid magnificence forms a striking contrast to the parsimonious meanness, which distinguishes the like buildings of the present day. In vol. iv. p. 70, of Dallaway's edition of Horace Walpole's Anecdotes of Painting, Hethrop, J. Phillip's church at Birmingham, a work of considerable merit, the quadrant porticoes at Chefden House, and a house at Roehampton, peculiar, but striking in its effect, given in the Vitruvius Britannicus, are mentioned as works of Archer. To him also is attributed the fanciful and attractive pavilion at the end of the piece of water which faces the centre of Wrest House, in Bedfordshire, the seat of the Earl de Grey. This pavilion is hexagonal in plan, with a porch at the entrance, and, with very little attention to effect, might be made a very graceful object, well worthy the splendid mansion which has been recently erected by the present noble possessor, from his own designs and under his own immediate direction, and in which his lordship has evinced a great feeling for art, sound discrimination, and a happy adaptation of the style chosen, which is that of the French château of the time of Louis XV.

Mr. Donaldson also read a brief memoir of the life of Chevalier Stefano Gasse, of Naples, an Honorary and Corresponding Member of the Institute.

THE ARCHITECTURAL SOCIETY.

W. Tite, Esq., President, in the Chair.

This society closed its session on the 2nd ult. with a conversazione, which was attended by Earl de Grey, the President, and many of the Fellows of the Institute of British Architects, also by Mr. Walker, the President, and numerous members of the Institution of Civil Engineers, besides many members of other scientific societies. The business of the meeting commenced by Mr. Grellier, the Hon. Sec. reading the report of the Committee detailing the lectures and papers that had been delivered, and the prizes awarded to the student members, and expressing their warmest thanks and acknowledgment to their President, Mr. Tite, for the energy and zeal with which he has forwarded the interests of the society.

The President then proceeded to award the prizes to the successful candidates, after which he read a paper of considerable research and interest, "*On Exchanges,*" which we have the pleasure of giving in another part of the Journal.

NOTES OF THE MONTH.

The Dean and Chapter of Westminster, we are happy to announce, intend to have twelve of the windows in Westminster Abbey glazed with painted glass. We hope that they will be ordered at once of the artists, and not of dealers, by whom the artists will be screwed down. Painters and sculptors are not subjected to such a vexatious process, and we do not see why painters on glass should be deprived of a great portion of the reward of their exertions.—The authorities at the Temple are also engaged in the restoration of their ancient church.

In the National Gallery, a very fine painting, the Infant Jesus, by Murillo, has recently been placed.

The Thames Tunnel will soon make its appearance on the Middlesex side. The Company have commenced clearing the houses for the purpose of prosecuting their labours with energy.

Mr. Cottingham the architect, invited a numerous party to a conversazione at his Museum of English Antiquities, in the Waterloo Bridge-road, on Thursday, the 25th ult. We, certainly, were never so much surprised on passing through the numerous rooms, to witness such an immense collection of specimens (about 31,000 we understand) of domestic and ecclesiastical architecture, painting, sculpture, and furniture; every architect, artist, and lover of antiquities should not fail visiting this Museum—next month we intend to give a description of it.

We understand that a National Mausoleum has been projected upon a most magnificent scale, to erect a sort of "Second Westminster Abbey," for the interment of the noble, opulent, and illustrious dead, and we have heard that the drawings are now ready, though we have not yet been fortunate enough to see them. We do not know who the author of the grand scheme is, but it is whispered that Barry is the chief architect, and a friend who has been favoured with a sight of the drawings, informs us that the design is noble, chaste, and beautiful, and a most perfect specimen of art. No doubt such a building is much wanted, seeing that a nich in the Abbey is not now to be had for either "love or money," or within its precincts, and hence the necessity of the intended National Mausoleum. We shall endeavour to obtain permission to reduce and engrave the drawings for our next number.

The experiment of the New Water Company which has been going on to test the quantity of water which can be procured and brought by its own gravity to London from near Watford, is now nearly completed. As far as it has gone it has been most successful. Copious springs have been tapped to the depth of 97 feet, and the well of 20 feet diameter when only 16 feet deep. required 30 men to be incessantly pumping from 4 a. m. to 8 p. m. daily, to enable the sinkers to proceed. Telford never made a happier hit than in pointing out this spot for the supply of London.

The Annual Meeting of the Council of the Government School of Design for distributing the prizes, took place on Friday, the 26th ult. We were much gratified on witnessing the great progress made by the students since the last yearly meeting, and the marked improvements that could be traced in those drawings that were made from models and plants. The school is in a very flourishing state, and there are not less than 100 pupils. Mr. Labouchere, the President of the Board of Trade, distributed the prizes. Among the company present we noticed Sir R. Inglis, Bart., M.P., Sir D. Norreys, Bart., M.P., Henry T. Hope, Esq., M.P., T. Wyse, Esq., M.P., Sir David Wilkie, and C. R. Cockerell, Esq., R.A., the latter gentleman read the report of the committee.

At Paris they are now employed in engraving on the bronze of the column of July, the names of the combatants who were killed during the revolution. These names are 504 in number, consisting of about 4000 letters, and placed in alphabetical order, letter A at the top. Each letter is 8 centim. (3¼ in.) high, and 3 millim. (⅛ in.) deep. A good specimen of *engraving on a large scale*. The artists have got as far as L. It it said that the elephant is to be cast at last, and erected at the Barriere du Trone, the decorations of which are to be finished; all this however is far from certain.—On the recommendation of the Commisioners for Preserving Historical Monuments, the Minister of the Interior has directed M. Viollet le Duc to prepare a plan for the restoration of the church of Vezelay (Yonne), and M. Questel plans for those of St. Giles (Gard), and Louillac (Lot), and for the cloister of Moissac (Tarn and Garonne).—The French naval authorities have directed experiments to be made at Brest on galvanized iron, and on gutters of zinc and of tin. The Commissioners appointed have already recommended the application of galvinized metal in several cases, in order to test its properties on a large scale. By police regulations the extent of the projections of plaster cornices is limited at Paris to 16 m. (6 in.)

REVIEWS.

Pictorial and Practical Illustrations of Windsor Castle, from original Drawings. By Messrs. Gandy and Baud. London: John Williams, 1840.

When Achilles died, Ajax and Ulysses contended for his arms, dire was the conflict, and great the perplexity of the Greeks in coming to a decision, they ended it, however, if we recollect aright, by making the award in favour of one of the competitors, not as we should propose to do by giving a bit to one, and a bit to another, or forcing them both to squeeze themselves into the same coat of mail. Since Sir Jeffry Wyatville's death, a similar contest has taken place, equally distressing as regards the parties engaged, and the difficulty of coming to a safe decision. Sir Jeffry anxious for his fame, and for the proper illustration of his great work, Windsor Castle, during his life time employed two of his pupils, Messrs. Gandy and Baud, and expended large sums on the preparations of the necessary drawings. His death left the enterprise unaccomplished, and by his will he directed his executor to provide for the completion of a task, dear to him even in death. Messrs. Gandy and Baud, artists of approved competence, who had been employed by Sir Jeffry himself in carrying out the works, had engaged to make the necessary drawings on condition that they should be the persons solely employed in carrying out a work, the importance of which they fully appreciated, and in which they also took an interest, as having their own reputation connected with it. From some cause, however, which has not been explained, a dissension has taken place between the executors and the artists, and each party has determined on producing a separate work. This step in such a case cannot but be deeply regretted, for neither the public nor the publishers can be benefitted by a contest of this kind, the latter must have a diminished sale, and the former a deteriorated work, instead of both parties making a profitable union, and devoting their whole capital and energies to the production of one magnificent volume.

The specimens we have seen of both the contending works are creditable and well executed, but we do hope that there is still time to conclude amicably a contest so distressing. The executors have the fame of Sir Jeffry in their keeping, and Messrs. Gandy and Baud, architects themselves, cannot be unmindful of the reputation of their former master, or of their own; the public are not so selfish as to wish for an injurious competition.

The illustrations of the Part before us consist, of a beautiful lithographic drawing of the North West View of the Winchester Tower, drawn by Mr. Gandy; of the North East View of the Prince of Wales and Brunswick Towers, drawn by Mr. Baud, and lithographed by Hawkins; and two engravings in outline exhibiting details.

A Treatise on Projection, with numerous Plates. By Peter Nicholson. London: Richard Groombridge. 1840.

Mr. Nicholson has laboured hard for the profession, but although far advanced in years, he is still as fresh as ever in supplying the wants of the professional student; to this class the volume before us will be of great service. We will give an extract from the preface, which in the author's own words best describes the utility of the work.

> The theory of projection is of universal application; a knowledge of this useful branch of delineation will enable the designer to instruct the workman with nearly as much ease as if he had the model before him, and to explain the effect of an imaginary object as if it really existed; this knowledge in the workman will enable him to forsee how the different parts of an object will join upon each other, to understand drawings and designs with readiness, and to execute them with accuracy.
>
> Among many other uses to which this truly admirable science extends its influence, may be mentioned the construction of the centerings of arches and groin vaults, the formation of hand-rails and stairs, the cutting of stones for bridges and oblique arches, and the delineation of plans, and elevations of buildings and machinery. But the utility of an intimate acquaintance with the principles of this useful art is not confined to the workshop alone, a certain knowledge of these principles should form a part of that stock of information which is essential to the student in the arts of design, and the rapid strides which have of late been made in other departments of the arts and sciences render it far from improbable that we shall shortly see the theory and practice of projection taught in our public schools, as a necessary branch of education.

Treatise on the Theory and Practice of Naval Architecture. By Augustin B. Crewse, Member of the late School of Naval Architecture, &c. Edinburgh: Black. 1840.

We regret that the space occupied by other matter prevents us from giving the remarks which we had prepared on Mr. Crewse's work. This is a reprint of the article Ship Building in the Encyclopedia Britannica, and gives in a short compass the elements of the history and theory of the art, and also a great deal of information upon construction. We recommend the work to the immediate notice of our readers, as we must ourselves defer the consideration of it until next month.

Chemistry of Science and Art, or Elements of Chemistry, adapted for reading, along with a Course of Lectures, for self instruction, &c. By Hugo Reid. Edinburgh: Maclachlan and Stewart. 1840.

Mr. Reid's work is what it professes to be, a portable compendium of the principles of chemistry, not aiming at the extent and research of large works, but eschewing the superficiality of what are called cheap works. It is sound, cheap, and useful, eminently calculated for the artisan and the student, deriving its information from the highest sources, and giving all the improvements of the latest date. We have only one thing to quarrel with Mr. Reid about—and he has treated upon the subject so clearly, that we are half inclined to let it alone—and that is, that he has in the beginning of his work enlarged upon two or three subjects, which might better become the subject of his forthcoming treatise on the classication of the sciences.

LITERARY NOTICES.

Mr. Rooke has brought out a new edition of his Geology as a Science applied to Engineering, in which he has detailed some of the results of his last year's tour in France.

Dr. Day will not think us inattentive to his pamphlet on the Doctrine of Parallels, in deferring our remarks upon it until next month, as it requires a serious perusal.

SAFETY VALVES.

The annexed engravings are referred to in the Report on the plans for preventing accidents on board Steam-vessels, at page 246.

Fig. 1.

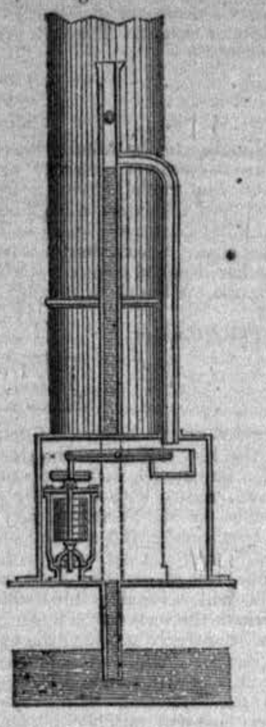
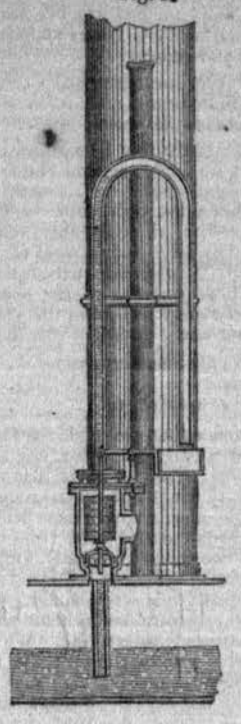


Fig. 2.



ON SUSPENSION BRIDGES.

Sir—I observe in your Journal of the past month, an engraving and description of "Dredge's Patent Suspension Bridge," you will find at page 23, vol. 1 of the Journal, an engraving and description of my bridge, which was presented to the British Association for Science at Newcastle, in 1838. Mr. Dredge's bridge was presented to the Association last year at Birmingham. The identity of principle in the two bridges is evident, and if it were desired to convert my construction into that proposed by Mr. Dredge, it would be merely necessary to unite each radial link with the one next it, but this would necessarily divert the rods from the diagonal line, representing the resultant of the two forces, tending to destroy the bridge, which would be a very unskilful arrangement, and attended with no practical benefit. I am not desirous to enter into a controversy upon this matter, but I think I may claim from you the small justice, of allowing me to state in your next number, my claims to be considered the author of this system of constructing suspension bridges; it may not be amiss to observe that my arrangement is much easier of construction than either that of Mr. Dredge, or the ordinary suspension bridge, and would be cheaper and stiffer than either.

I remain, your obedient servant,
W. J. Curtis.

15, *Stamford Street, Blackfriars Road,*
June 17, 1840.

WYRE LIGHTHOUSE.

In our last number we gave an engraving and description of the Wyre Lighthouse, together with the Specification, with the signature of "Henry Mangles Denham," at the end, by which it may appear that the design and specification was that of Captain Denham, instead of which it will appear by the following letter to have been entirely the production of Messrs. Mitchell and Son.'

TO THE EDITOR OF THE PRESTON PILOT.

60, Pall Mall, London, May 9th, 1840.

Sir—It is right that the public should clearly understand that the specification of the Wyre Lighthouse was the production of Messrs. Alexander Mitchell and Son, and only signed by me to show I had considered, approved, and caused its adoption. Your inserting this note in your next paper will oblige your humble servant,

H. M. Denham,
Consulting Marine Surveyor.

THE PROJECTED MERCHANT SEAMAN'S INSTITUTION.

(See Plate.)

The grandeur and great public importance of a project, the particulars of which accompany our Journal this month, will, we trust, excuse our departing somewhat from our usual course, in criticising a work at present to a certain extent undetermined, but which we prophecy will at no distant period be equally the pride and protection of the vast and deserving class for whose benefit it is especially intended, as a glorious and lasting monument of the national estimation in which they are so justly held.

The style selected, Palladian, so eminently suitable to buildings of large extent and intricate internal arrangement, and the boldness and simplicity of the ensemble, evince considerable judgment and taste in the artist, whose name however does not appear.

The plan is quadrangular, the entire length of the façade, we are informed, about 700 feet. The lower story consists of an arched and rusticated basement, supporting and subservient to the principal design which is of the Corinthian order; the entablature continued throughout and unbroken by those unnecessary and unmeaning projections which so frequently disfigure the best compositions; the central feature of the design is an octastyle portico of magnificent dimensions, upwards of 100 feet in extent, supported by an open loggia communicating with an arcade surrounding the quadrangle, and surmounted by a dome novel in design, but in harmony with the general character of the composition. Such are the leading features of the exterior;—of the interior we can give no opinion, the very excellent method having, we understand, been adopted of arranging it with reference to the opinion and advice of those who are practically acquainted with the purpose to which it will be devoted. We shall, however, keep a strict watch over its progress, and trust no petty interests or party feelings will interfere with the completion of so useful, so creditable, and so magnificent an undertaking.

STEAM NAVIGATION.

"THE RUBY" CHALLENGE.

Sir—The letter which appeared in the last number (for June) of your valuable Journal, signed by "A. Billings, Manager of the Diamond Steam Packet Company," has excited considerable stir amongst steam-boat parties. I do not, however, observe in that letter the public challenge[*] which the "Ruby" gave in the Nautical Magazine for this month, and in the latter periodical Mr. Billings, as "Manager of the Diamond Steam Packet Company," says, "I am *ready* to match the Ruby to run from Gravesend to Margate and back for 200 guineas against *any* boat afloat, whatever may be her size, power, or build."

Now your numerous readers may like to know if and how the match came off, and I beg a space in your columns to state the matter fairly.

I accepted the challenge through Mr. Roney, the Manager of the Polytechnic Institution immediately, and submitted that the conditions should be—to engage to run on a certain day, three weeks notice to be given.

To deposit 200 guineas each. The course to be from Gravesend round a boat moored off Margate wood pier. Time of starting to be named at once, and to take all chances of weather.

Sails to be used or not as the challenger pleased. Here I will only observe that as I should have to get the "Fire King" round from the Clyde, a distance of 850 miles, I stipulated for the above conditions as to time, believing the "Ruby' to be "ready." On the 13th Mr. Roney received answer from Mr. Billings, (but not signed by him as Manager of the Diamond Company), asking the "name of the boat, her tonnage and power, and the time she has been running, *when* (*i. e.* Mr. B.) shall be willing to enter upon the terms of the match."

Having read so much of his answer, and finding that his former words "*any boat afloat*," and his being "*ready*," were now appearing in a new light, I was amused to find the following philanthropic evasion thrust in, "provided that your vessel is worked by low pressure steam, as I feel convinced that the Diamond Steam Packet Company would not on any account whatever endanger the lives of their fellow creatures, by permitting their boat to enter into a contest with any vessel propelled by so hazardous an agent as high pressure steam!" and his letter concluded, "I shall be obliged by an answer to the foregoing before entering on the details of the match."

I protest that my regard for the lives of my fellow creatures is just as great as that of Mr. Billings and his Company—and I do consider that part of the letter mawkish in the extreme.

But the Ruby was not to get off the match quite so easily. I answered in the following words: that "I accepted the published challenge on the part of the owner of the 'Fire King,' of 603 tons, and with 57¼ inch cylinders low pressure. She is private property and on no station for passengers; she has been afloat to *my* knowledge seven months,[†] but that has nothing to do with *your* challenge, further than that the 'Fire King' comes within the words used by you, 'any boat afloat, whatever may be her size, power, or build.'" Again I pressed him to conclude the terms of the match, and signed myself as agent for Robert Napier, of Glasgow, who owns the Fire King.

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[*] We purposely omitted the paragraph, as we did not wish the Journal to be made the medium of betting.—Ed. C. E. and A. Journal.

[†] She has been afloat much longer.

Again I found the Ruby at fault, for Mr. Billings replied on the 15th June, that as the "Fire King" is low pressure, there could be no objection to make the match, *but* that his challenge was published when the Ruby was "lying up in dock, " at the present time the season is at its heat, and all the boats of the Diamond Company are in full employment, and the Ruby could not be spared off her station just now, she being their principal boat, you must therefore let the match stand over until the end of the season, when the Ruby could be withdrawn from her station for a few days for the purpose, if (mark the saving word 'if') the conditions are agreed to."

To this I answered on the 16th June, " your favour of the 15th has, I must say, surprised me. In this month's " Nautical Magazine you published your challenge, wherein you had to repeat 'that you were *ready* to match the Ruby to run from Gravesend to Margate and back for 200 guineas, against any boat afloat, whatever may be her size, power, or build." This was published on the 1st of this month. Mr. Robert Napier, the owner of the Fire King, met with your challenge some days afterwards in Glasgow, and although much disinclined to race, he could not allow it to pass unheeded, or your ship to be published as faster than the Fire King. He lost no time in instructing me, and on the 9th instant your challenge was accepted in London. You publicly stated that the Ruby was "*ready*," both last month and this month, after your season had commenced, but now when you have learned that the Fire King accepts your challenge, you object to run until after your "season" has finished.—I therefore now call upon you, and those concerned with you, to complete the match, as you are bound in honour to do within a reasonable time."

"Requesting the favour of an immediate answer, I am Sir, your's, &c."

My next and last letter from Mr. Billings " begs me to recollect that the Ruby is the property of a Public Company, whose engagements being completed for the season, they will not permit the boat to be withdrawn at present from the station."—So that the grand challenge ends thus in nothing; and I am confident your readers will conclude with me, that the Ruby shuns the trial altogether, and many of your readers will think as I do, that the Gasconade challenge was given in Mr. Billing's letter (which by-the-bye condemns "swaggering and boasting") merely to puff the Ruby or her engineers, in the vain confidence that no one would accept it. I beg to assure you I intend nothing disrespectful to Mr. Billings or his Company, or to those behind the scenes; it is a pity they should thus have tarnished the lustre of the Ruby.

I have now only to conclude by giving to you the "Fire King's" rate of steaming as ascertained on the Gare-loch last October, in presence of Mr. John Wood the well known ship-builder, Mr. Lloyd the assistant-surveyor of steam machinery of the Navy, Mr. J. Scott Russell, Mr. Robert Napier, and myself.

		min.	sec.		miles	
No. 1	measured mile	4	9	=	14·45	per hour.
2	..	3	43	=	16·14	
3	..	3	58	=	15·13	
4	..	4	13	=	14·22	
5	..	4	5	=	14·69	
6	..	3	42	=	16·21	
7	..	3	57	=	15·19	
8	..	4	16	=	14·06	
					8) 120·09	
Land miles on the average per hour.					15·01	

The miles were measured by us in three different and distinct parties, and the times taken by each individually. The Fire King's measurements are as follows:—

	feet.	in.
Length over stem and stern posts aloft....	180	5
Length of keel and fore rake	175	5
Breadth between paddles	28	0½
Depth in engine-room	16	8¾

Making in all 663 tons O. M.

I am, Sir, your most obedient servant,

ALEXANDER GORDON,
Agent for Robert Napier of Glasgow.

22, Fludyer-street, Westminster,
June 23, 1840.

LAUNCH OF TWO IRON STEAM-SHIPS AT LIVERPOOL.

The confidence entertained in the good properties of iron vessels, and particularly their advantage in combining strength with that light draught of water requisite in some branches of trade, in peculiar localities, is becoming daily more and more confirmed, by the success, both at home and abroad, of the ships built of that material, and the improvements in their construction which experience enables the builders to introduce. It is not, therefore, improbable, but in twenty years hence, or perhaps within a shorter period, one half of our mercantile marine may be of iron, copper, or some composition of various metals that may be wrought by hammer, or cast in pieces, and afterwards jointed, to any given mould or model.

Be this as it may, the construction of "steam" vessels of strong sheet iron is evidently much on the increase, particularly here and at Glasgow, the two ports that were the first, we believe, in this country, and are still the most successful, (being put to their "metal") in directing their energies to steam navigation. The "iron fleet" of England is consequently receiving rapid accessions; and not contented with turning out one vessel at a time, Mr. John Laird, has several on the stocks at once, and on Saturday morning, 6th ultimo, launched two from his yard at North Birkenhead by the same tide! The time appointed (the tide being early) was about nine o'clock, and by that hour a large concourse of persons, including many ladies and gentlemen from the neighbourhood, and not a few from this side of the water, were in attendance. Both the vessels were decorated with flags, and some parties, besides the workmen, preferred going on board and being launched with them.

The first one launched was her Majesty's steam-vessel *Dover*, to be placed on the station between Dover and Calais, or Ostend. The following are her dimensions and capacity:—

Length (per measurement)	110 feet
Breadth, or beam do.	21 feet
Will admeasure about	230 tons.

The Dover is the first iron vessel belonging to the Admiralty, and on her success will, no doubt, depend the future adoption of vessels of her build by the government. She is of a remarkably fine model, having a degree of rotundity in her sides, with ample bearing, and a fineness in her lines, fore and aft, which will, in all probability, ensure her a degree of speed and safety not yet attained by any steam-vessel of her size. A few minutes after nine the word was given, and she rushed into her destined element in gallant style, amidst the hearty cheers of the spectators, followed by a salute fired from cannon on the quay adjoining the yard.

The second vessel launched was the *Phlegethon*:—

Length (per measurement) . . .	157 feet 6 inches.
Breadth	26 feet.
Capacity, upwards of	500 tons.

She is intended for sea and river service, on, we believe, a foreign station, and will carry two long guns, one at the bow and one at the stern, to work within a circle. This vessel is also of a fine model, with ample bearings, so that she may carry sail when required, either with steam or without it, as her paddle-wheels, on a new principle, by Mr. Forrester, may, when required, be thrown out of gear. She is handsomely, and we may add, rakishly rigged as a two-masted schooner, and will, we doubt not, prove to be a clipper.

She was launched about half-past nine o'clock, and the sight was one of the most gratifying ever beheld. She had a considerable distance to run down the ways before her forefoot reached the water, which she took like a swan breasting its native lake. We need scarcely say that the welkin again rang with the acclamations of the spectators, who lined the yard and the neighbouring shores, and which were returned with equal enthusiasm by those who stood on her decks. When afloat, the impression she conveyed from her length and sharpness, was that of a very fast and mischievous looking craft. She has a fine flush deck, and her paddle-boxes do not rise to an unseemly height over her gunwale.

We believe this is the first instance of two iron vessels being launched from the same slip by the same tide, nor do we recollect a case occurring in Liverpool of two wooden vessels of so large size being launched in one tide.

Both vessels exhibit many improvements in their construction, not tried in any iron vessel previously built; and which render them two of the strongest iron vessels afloat. They are now receiving their machinery,—the Dover, from Messrs. Fawcett, Preston & Co., and the Phlegethon from Messrs. Forrester & Co's establishment. Both, it is expected, will be ready in the course of the present month.

Mr. Laird is now building three iron steam-vessels to compose the new expedition about to be sent by government up the river Niger, under the command of Captain Trotter.—*Liverpool paper*.

The Archimedes.—This experimental vessel is gradually working its way all round the coast, exhibiting its powers at the principal ports. It was at Liverpool last month. On the 10th ult., we find by the *Liverpool Standard*, she made a trip, and shortly before reaching the Crosby Light-ship, the Duchess of Lancaster steam-ship was perceived making directly for the port, and as she was known to be a remarkably fast sailer, and Mr. Smith being desirous of proving the capabilities of the Archimedes, immediately 'put about,' and awaited the arrival of the former vessel. On coming up, the screw was immediately put in motion, and the two vessels went admirably together for some distance, though we are bound in fairness to state that the Duchess had a very slight advantage in respect of speed, owing, as will be seen from the subjoined comparison, to her proportions as to power, draught, &c., being better adapted for quick sailing. The Archimedes had also the full strength of the tide to contend with, whilst her competitor ran the whole distance in the eddy. This is the first time the Archimedes has been beaten, with one or two slight exceptions.

ARCHIMEDES.		DUCHESS OF LANCASTER.	
Diameter of cylinder	37 in.	Diameter of cylinder	40 in.
Stroke	3 ft.	Stroke	3 ft.
Tonnage..................	237	Tonnage..................	238
Draught	10 ft.	Draught..................	6 ft.
Estimated steam-power ..	80-horse	Estimated steam-power ..	90-horse
Length between perpendiculars	107 ft.	Length between perpendiculars	120 ft.
Beam	22ft. 6 in.	Beam	20 ft.
Area of midship section at 10 feet draught............	143 ft.	Area of midship section at 6 feet draught	100 ft.

As there was a feeling on board relative to the slip or loss of power from the screw, the following explanation will doubtless be satisfactory:—The screw, being 8 feet pitch, would, if working in a solid, advance 8 feet for each revolution; but, working in a fluid, the relative difference between the speed of the screw and the vessel appears, *at first sight*, to be considerable, from the *supposed* oblique action of the propeller. The following mode of calculating the speed of both will show that the difference is barely one-sixth, which is considerably less than that of ordinary paddle-wheels.

"The number of revolutions of the engine per minute is 26, which, multiplied by the spur wheels $5\frac{1}{3}$ times, gives that number of turns to the screw for one of the engine.

26 revolutions of the engine per minute.
$5\frac{1}{3}$ multiple.

138 revolutions of the screw per minute.
8 feet pitch of screw.

1104 *feet* travelled per minute.
20 being $\frac{1}{3}$ of 60, to bring it into

22,080 *yards* per hour,

which, divided by 1760 (the number of yards in a statute mile), gives us 12 miles 160 yards per hour as the speed of the screw. Speed of the vessel for 26 strokes per minute, 10 10-25 miles per hour by the log."—She left Liverpool on the 11th ult., for the Isle of Man, and performed the run in the short space of seven hours and 25 minutes, which is an unusually quick passage. The *Mona's Isle* was fully two hours longer doing the same distance on the same day, starting about half an hour later than the *Archimedes*. The *Mona* is 10 horses power more than the *Archimedes*, with considerable less tonnage, and drawing two feet less water.

Royal Mail Steam Packets.—The contract of the "Royal Mail Steam-packet Company" with the commissioners has just been printed, in return to an order of the House of Commons. The company covenant to keep a sufficient number (not less than 14) of good and efficient steam-vessels, which shall be able to carry guns of the largest calibre now used on board of steam-vessels of war, supplied with engines of not less than 400 collective horse power, as well as with men, apparel, &c., and be of at least 1,000 tons burden. One of these vessels is to leave a port in the British Channel twice in every calendar month, and proceed to Barbadoes, as soon as the mails are on board. After an interval not exceeding six hours from her arrival there, she is to proceed to Grenada, and after remaining a time not exceeding 12 hours, go with the mails on board to Santa Cruz, thence to St. Thomas's, thence to Nicola Mole in Hayti, thence to Santiago de Cuba, and thence to Port Royal in Jamaica. After remaining at Port Royal for an interval not exceeding 24 hours, the vessel, after delivering her mails and receiving others, is to proceed to Savannah la Mer, and after a delivery and receipt of mails there, to Havannah in Cuba. After an interval not exceeding 48 hours she is on her return to proceed from Havannah to Savannah la Mer, thence to Port Royal, thence to Santiago de Cuba, thence to Nicola Mole, thence to Samana in Hayti, delivering and receiving mails at each place, care being taken that she shall always arrive at Samana, after performing her voyage from Barbadoes, on the 22nd day after the arrival of the mails at Barbadoes from England. From Samana she is to make the best of her way back to England. Immediately on the arrival at Barbadoes of every steamer employed under the contract, another of such steam-vessels is to proceed with her mails from Barbadoes successively to Tobago, Demerara, Berbice, and Paramaribo. The period of delay at Paramaribo is not to exceed 48 hours, and then the vessel is to proceed to Berbice, Demerara, Tobago, Grenada, and Barbadoes, always arriving at Barbadoes in time to depart immediately for Tobago on the arrival of one of the vessels at Barbadoes from England. On the arrival at Grenada of a mail from England, another of the steam-vessels is to proceed from Grenada successively to St. Vincent, St. Lucia, Martinique, Dominica, Guadaloupe, Antigua, Montserrat, Nevis, St. Kitt's, Santa Cruz, Tortola, St. Thomas's, St. Juan's (in Puerto Rico), Samana, Curaçoa, Porto Cabello, La Guayra, Trinidad, and thence back to Grenada, so as always to be ready to depart thence with the mails on their arrival from England. Another vessel likewise, on the arrival at Grenada of the mails from England, is to proceed with the mails successively to the Port of Spain (in Trinidad), La Guayra, Porto Cabello, Curaçoa, Samana, St. Juan's, St. Thomas's, Tortola, Santa Cruz, St. Kitt's, Nevis, Montserrat, Antigua, Guadaloupe, Dominica, Martinique, St. Lucia, St. Vincent, and thence back to Grenada, so as to be ready to depart immediately on the arrival of a mail from England. On the arrival of any vessel at Curaçoa from Grenada, a sailing vessel is to be ready then to proceed from Curaçoa to Santa Martha, and thence to Carthagena, where she is to remain 24 hours, and then return to Santa Martha and Curaçoa. On the arrival of a mail from England at Nicola Mole, another sailing vessel is to proceed thence to the Bahama Islands, and after remaining at New Providence for not more than 72 hours, return to Nicola Mole in time to meet the steam-vessel. On the arrival of the mail from England at Port Royal, another steam-vessel is to proceed thence to Chagres, Carthagena, Santa Martha, and thence back to Port Royal in time to meet the return vessels from Havannah. On the arrival of the mails from England at Savannah la Mer, another sailing vessel is to proceed thence to Trinidad de Cuba and Belize (in Honduras), where after remaining 48 hours, she is to return to Savannah la Mer by the same route. On the arrival at Havannah of the mails from England, another steam-vessel is to proceed thence with the mails to Vera Cruz, Tampico, Mobile, or such other port as the commissioners shall determine, returning from the last port to Havannah in time to depart for Vera Cruz immediately on the arrival of the English mail, and another to the Gulf of Mexico, Tampico, and Vera Cruz, and then back to Havannah to meet the mails. Another steam-packet, on the arrival of the mails from England at Havannah, is to proceed to Mantanzas in Cuba, and to New York, stopping at intermediate ports to be named by the commissioners, and thence to Halifax, returning back to Havannah, by the same route on the arrival of the mails from England. The contract is to commence on the 1st of December, 1841, or at an earlier period, if mutually agreed, and to continue in force for ten years from the first day on which the first vessel shall put to sea for Barbadoes, and for a longer period, unless determined by twelve months' notice in writing.

Transmission of the Mails to North America.—The contract entered into about a twelvemonth since for the conveyance of the mails by steam-packets of 300 horse power and upwards from England to North America will come into operation immediately, the Britannia steam-ship having arrived at Liverpool to carry out the first mail: she is to be followed by the Arcadia, Caledonia and Columbia, all large and powerful vessels. The terms of the contract are, that the mails shall be conveyed twice in every month from Liverpool to Halifax in Nova Scotia, and from Halifax to Boston in the United States, and, while the St. Lawrence is navigable in smaller steam-vessels, from Pictou in Nova Scotia to Quebec in Canada. The mails to return by the same route, twice a month to Liverpool. The contract is for seven years certain, and the contractor is to be paid for performing this service at the rate of 60,000*l.* per annum.

Steam to Alexandria, Egypt.—The steam ships *Oriental* (late the *United States*) and *Liverpool*, have been engaged by government to carry the mails between England and Egypt. The *Oriental* will be ready to sail from Falmouth for Alexandria on the 1st of August, to be succeeded by the *Liverpool*, which will depart on the 1st of September. These vessels will call at Gibraltar and Malta, in going and returning; and they are to be only 15 days on the passage to Egypt, and the same time on that back to England. Both ships will, it is expected, sail regularly from and to this port, calling at Falmouth to receive and deliver the mails and passengers; so that one may shortly take a trip hence direct to Egypt, and behold, in a brief visit, all the wonders of that once glorious land.

PROGRESS OF RAILWAYS.

ATMOSPHERIC RAILWAY.

We attended on Thursday, the 11th ult., at Wormholt Scrubbs, to witness an experiment on a portion of the Birmingham, Bristol and Thames Junction Railway, which had been laid down by Messrs. Clegg & Samuda, on their patent atmospheric principle; as might have been expected, the practical introduction of a system so different from that now in use on other railways, excited considerable interest.

The idea of employing the power of the atmosphere, against a vacuum created in an extended pipe, laid between the rails, and communicating the moving power thus obtained to propel carriages travelling on a road, we believe originated with Mr. Medhurst, who laid before the public details of his plan in a work he published in 1827, entitled "A New System of Inland Conveyance"; indeed so far back as 1812 he published some ideas on this method of locomotion. About 1835 some experiments were made with a model in Wigmore Street, by Mr. Pinkus, very similar to those described by Mr. Medhurst; these experiments, however, failed, from the same cause which probably prevented Mr. Medhurst from carrying his into effect, viz., the impossibility of making the continuous communication from the inside of the pipe to the carriage tight enough to allow a useful degree of rarefaction to be produced. Messrs. Clegg & Samuda's invention overcomes this difficulty in a very simple manner; indeed the constructing and closing this continuous valve, by *hermetically sealing it up with a composition* each time a train passes, forms the main feature in their invention.

The portion of the line selected on which the experiments were made is half a mile long, with a rise of 1 in 120 for rather more than half the distance, and 1 in 115 for the remainder. A continuous cast iron pipe or tube 9 inches in diameter, is fixed between the rails, and bolted to the sleepers which carry the rail chairs; the inside of this pipe, which is unbored, is lined with a strong lubrication of pressed tallow about $\frac{1}{16}$ of an inch thick, which equalizes the surface, and prevents any unnecessary friction from the passage of the travelling piston through it; along the upper surface of the pipe is a continuous slit or groove about $1\frac{1}{2}$ inch wide. This groove is covered by a valve extending the whole length of the railway, formed of a strip of leather rivetted between iron plates, the top plates being wider than the groove, and serving to prevent the external air forcing the leather into the pipe when the vacuum its formed within it, and the lower plates fitting into the groove when the valve is shut, makes up the circle of the pipe, and prevents the air entering the tube; one edge of this valve is securely held down by iron bars fastened by screw bolts to a longitudinal rib cast on the pipes, and thus allows the leather between the plates and the bar to act as a hinge, similar to common pump valves; the other edge of the valve falls into a groove which contains a composition of bees-wax and tallow; this composition is solid at the temperature of the atmosphere, and becomes fluid when heated a few degrees above it. Over this valve is a protecting cover, which serves to preserve it from snow or rain, formed of thin plates of iron about 5 feet long, hinged with leather, and the end of each plate underlaps the end of the next in the direction of the piston's motion, thus insuring the lifting of each in succession. To the underside of the first carriage in each train is attached the piston and its appurtenances; about six feet behind the piston, the horizontal piston-rod is attached to a connecting arm which passes through the continuous groove in the pipe, and being fixed to the carriage, imparts motion to the train as the tube becomes exhausted of the air; attached to the piston rod, and preceding the connecting arm, two steel wheels are fixed, which serve to lift the valve to allow the connecting arm to pass, and also for the atmospheric air to impinge immediately on the back of the piston; another steel wheel, which is attached to the carriage by a spring, serves to ensure the closing of the valve, by running over it immediately after the piston has passed, in case it should not fall by its own weight. A copper tube about 10 feet long, which is constantly kept hot by a small stove, also fixed to the under side of the carriage, passes over the surface of the composition (which has been broken up by lifting the valve out of it), and rendering it fluid, which, upon again cooling, becomes solid and hermetically seals the valve. Thus each train, in passing, leaves the pipe and valve in a fit state to receive the next train.

For the purpose of exhausting the tube a steam engine of 16 horse power is employed, which works an air-pump or exhauster 37½ inches diameter, and 22½ inches stroke, making from 40 to 43 strokes per minute. The air-pump is connected with the exhaust tube in the centre of the railway, by means of a branch pipe 9 inches diameter leading from the air-pump.

To calculate the power of this kind of apparatus, it is nescessary to ascertain the state of vacuum and the difference of the pressure of the atmosphere which forces the piston forward; in the present experiments the vacuum was equivalent to from 18 to 20 inches of mercury, which will give for the useful pressure of the atmosphere on the piston about 9 lb. on the square inch. The area of the tube, 9 inches diameter, is equal to 63·62 square inches, and this multiplied by the pressure, will give

$$9 \times 63{\cdot}62 = 572{\cdot}58 \text{ lbs.}$$

for the pressure on the back of the piston, or the moving power.

The load conveyed at each experiment may be taken as follows:—

Two carriages........................ = 4 tons.
Apparatus attached .... = 1 ton.
Forty-five passengers .... = 3 tons.

Total load conveyed .... = 8 tons.

The stationary engines and air pumps on this system may be fixed in distances varying from one to four miles apart, to suit the traffic and convenience of the line of road; each section or length of pipe acted on by one engine is confined between two valves; the vacuum is created to about 18 to 20 inches of mercury before the piston enters the pipe, and is maintained during the passing of the train by the engine being kept at work; having passed through one section of pipe, the momentum the train has attained, serves to carry it on to the next section, which commences at about 100 or 200 yards beyond, and the entrance separating valve of the second section being opened by the carriage immediately after it has entered, allows the vacuum prepared in this section to act upon the piston; thus the train can pass from section to section without end, and without any stoppage.

Experiments.—For the purpose of ascertaining the relative velocity on various portions of the half mile, it was divided into 20 sections of 2 chains or 44 yards each. The carriages were started from a state of rest at the foot of the inclined plane of one in 120, and allowed to run up the incline of half a mile before the break was applied to arrest the progress of the carriages. When two carriages were attached, they run over the ground, after passing the first 5 divisions at the velocities of 7, 6, 5, and 4 seconds to each section, which is equivalent to 13, 15, 18, and 22½ miles per hour; and when *one* carriage only was attached, it run over the ground at the velocities of 6, 5, 4, and 3 seconds to each division, which is equivalent to 15, 18, 22½, and 30 miles per hour. The last division in each experiment was done at the greatest velocity, which clearly shows that had the experiment been made on a mile run instead of a half mile, the experiment would have been far more favourable and satisfactory; and if the experiment had been made on a level, about four times the above load might have been conveyed at the same velocity.

We noticed that it took about 1½ minute to raise the vacuum each trip, to about 18 inches of mercury.

From the above experiments, the loads drawn, and the speed attained, will be as good a criterion of the success of the undertaking at we can have, and when we consider that in producing these results, the patentees must have been wholly unassisted by any previous examples, we think that the greatest credit is due to the talent and ingenuity they have displayed. The system appears to us to possess many advantages which must insure it the serious consideration of the engineer. The carriages travel without noise, and without the risk of explosion, or of getting off the rail. It does not seem possible that a collision of trains can take place, for two trains cannot receive power from the same section of pipe at the same time, neither can they receive power in opposite directions on the same rail. The speed on this system must be proportioned to the capacity of the air-pumps used to maintain the exhaustion in the tubes, and therefore any rate of travelling that may be deemed desirable may be easily attained.

French Railways.—The Railway Committee held another meeting last week in Paris, and after hearing parties interested in the five companies affected by the Government bill, took into special consideration that part of the measure which relates to the lines from Lille and Valenciennes to the Belgian frontiers. The Committee approved of these two lines being executed by Government, not only on account of precautions that might be rendered necessary by the defence of the frontier; but also because the formation of treaties with Belgium might render it desirable that these lines should be in the hands of the State. The Committee was of opinion that the termination of these lines was the more called for, since the Belgian lines to the frontier were already executed. The line from Lille to the frontier near Mouseron is 14,125 meters in length, or 47,000 English feet; and that from Valenciennes to the frontier near Quievrain is 63,128 metres, or 43,000 feet; the first is to cost 1,000,000f., the latter 4,000,000f. The Committee adopted this part of the bill almost unanimously, as also the lines and surveys as approved of by the administration of the Ponts et Chaussees.—*Railway Times.*

Llanelly Railway.—The present state of the new line is as follows:—From the Dock at Llanelly to Parkrhyn (main line) eleven miles, and from thence up to the terminus of Cwm Amman branch, six miles, altogether seventeen miles, the line has been completed and open for traffic, over which the locomotive engines of the Company are travelling.—From that point, viz. Parkrhyn, up to Duffryn Lodge (about a mile and a half further on the main line) the same is nearly completed, the rails having been laid, and the filling in in progress.—From that point on the main line, viz., Duffryn Lodge, the branch leading to Mr. Long Wrey's collieries, and Messrs. Morris, Sayce, and Co.'s, is in course of forward progress, and will be completed by 1st January next, this branch is altogether about four miles in length, and leads to several collieries of capital coal. The Company have entered into a contract with Mr. Wrey, to bring for seven years at least 10,000 tons yearly down this branch, which will yield railway and dock dues, as a minimum amount, the sum of 1,000*l.* per annum.—The two new locomotive engines to which reference was made in the last annual Report as then ordered, are now at Llanelly, and one of them, the *Albert*, is engaged in traversing the line, in hauling coal down to Llanelly. The Committee are persuaded that the carrying trade which will thus be secured to them by locomotive power, will be a source of profit when the quantity of coal, iron, &c., shall be increased: whilst as an auxiliary to the general traffic the use of steam power is unquestionably of great importance.—*Directors Report.*

Preston and Wyre Railway.—The Directors have made an arrangement for one year with the North Union Railway to supply this Company with locomotive engines at 2*s.* 4*d.* per mile per train, and with the first-class carriages at a penny per mile each, and with second-class at a-halfpenny per mile each. This will prevent the present outlay of a considerable capital, a circumstance particularly desirable until the extent of the traffic on the line has been ascertained.

Great North of England Railway.—The works of the Great North of England Railway between York and Darlington, are in so forward a state, that the Directors of the Company have employed Mr. Green, of Darlington, architect, to furnish designs for depôts upon the line.—*Leeds Intelligencer, May* 30.

The Cheltenham Railways.—Within the last few days the bank which separated the Birmingham and Gloucester works from the Cheltenham and Great Western, between the station and Lansdown Bridge, has been cut through, from which circumstance we should infer that a satisfactory arrangement has been entered into by the two Companies. The greatest exertions are making to complete the work up to the Lansdown bridge, and from the number of hands employed, and the activity displayed, we should fancy that a very short space of time will suffice for the attainment of that object.—*Cheltenham Journal.*

Locomotive Carriage.—Mr. Hills lately made a very successful trip to and from Camberwell and Brighton with his patent locomotive carriage, the distance from Camberwell to Brighton was performed in 5 hours and 10 minutes, out of which time one hour 21 minutes was lost by delays in obtaining a supply of water at the inns, and 10 minutes delay on the road. The return trip was accomplished in 5 hours 22 minutes, out of which time one hour four minutes was lost by delays in obtaining water, and 26 minutes delay by stoppages on the road; the delays in obtaining water will be reduced very considerably, when proper stations and stated periods for arrival are made, the whole of the stoppages need not occupy more than 12 minutes, which, according to the speed the carriage ran on the road, the journey from London to Brighton might be very well accomplished in about three hours and a half. Our correspondent, who accompanied Mr. Hill on his trip to London, states that the form of the carriage is a handsome britzka, that there is scarcely any noise from the working of the engine, or escape of steam, and no appearance of smoke; on descending hills it is easily regulated by powerful retarders, and guided with the greatest facility. We hope at some future time to be able to give some additional information connected with the cost of a carriage, and the working of the same.

NEW CHURCHES, &c

Plymouth.—On Tuesday 20th May the foundation stone was laid of a new Church in Southside-street, in this borough, and which is to be called "Trinity Church." From the peculiar circumstances of its locality, it differs greatly from the usual form of New Churches. Its interior may be described as a square of about 70 feet, divided into three parts by two parallel Tuscan colonnades, each surmounted by an attic range of semicircular windows, forming a *clerestory* as in our cathedral churches. The traverse section of the building, therefore, exhibits a nave of about 35 feet high, by 37 feet wide, and two aisles, each about 25 feet high, by 16 feet wide, the galleries being constructed along the latter. The building being surrounded by houses, &c. on the north, south, and west sides, the only light, in addition to that of the clerestories, is derived from three windows at the east end, the central one being a large three-light Venetian window over the altar, which terminates a recess extending about 14 feet eastward from the main body of the church; on each side of the altar projection is an entrance porch; and there is a third porch in the centre of the north side to afford an entrance from Southside-street. The bell turret, surmounting a pediment over the great east window, is in the simple form of an arch flanked by pilasters, and crowned with a small pediment, a repetition of the larger one below. It is anticipated that the perspective of the interior looking from the western end will be boldly picturesque and ecclesiastical; that the effect of the lofty clerestories will be not less striking, than novel, as a modern application of Italian architecture; and that the altar-piece, with its triple Venetian window over, will form an imposing termination to the vista. The church is calculated to afford accommodation for about 1100 sittings, of which 650 are free. George Wightwick, Esq., is the architect.

Northamptonshire.—The Hon. H. Watson, brother of Lord Sondes, with praiseworthy munificence, intends erecting a new church at Guilsborough, entirely at his own expense. The cost of the building, it is said, will amount to upwards of 5,000*l.*